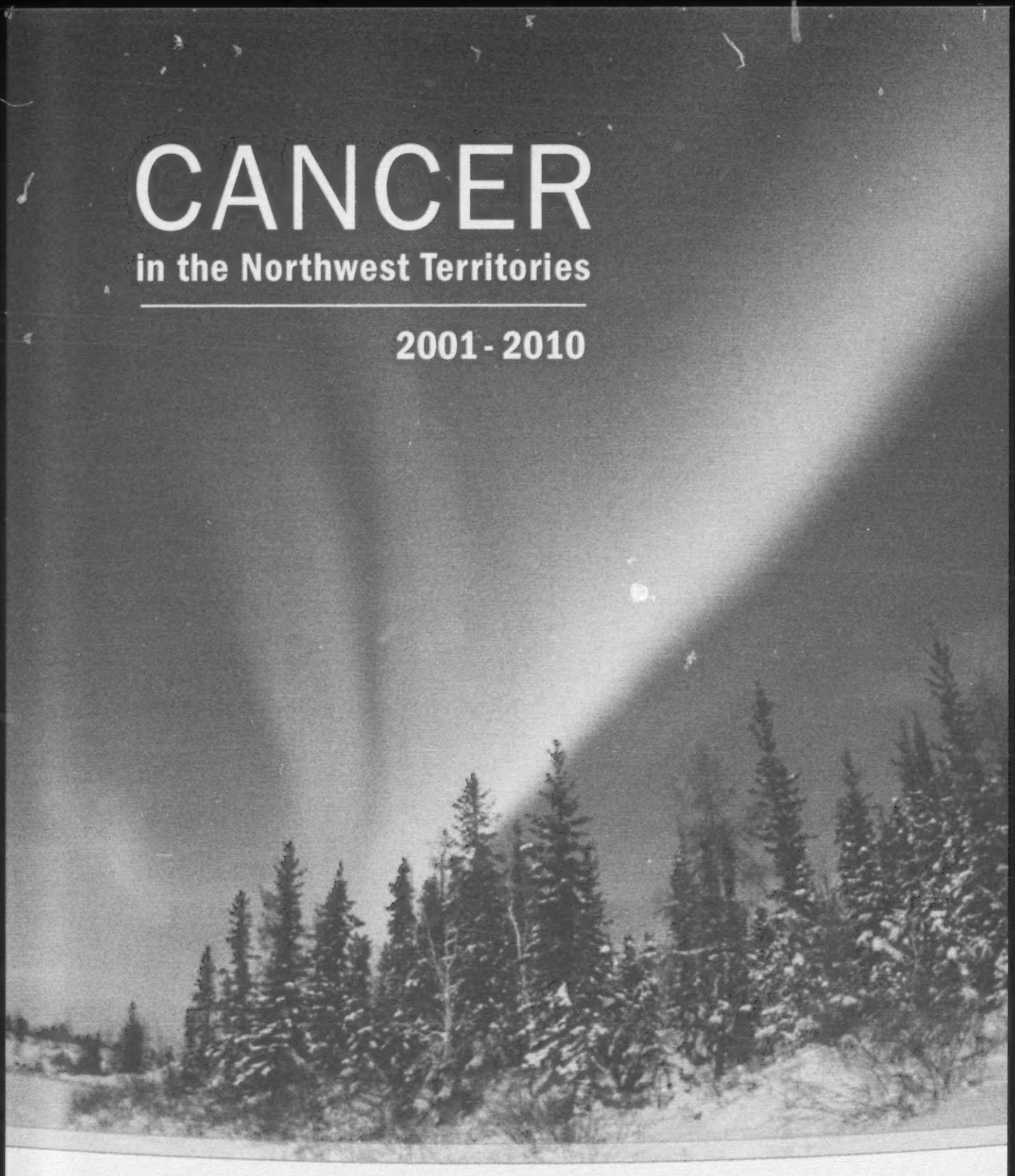
CANCER

in the Northwest Territories

2001 - 2010



Northwest Territories Health and Social Services

March 2014 | www.hss.gov.nt.ca

Contents

Message from the Minister 1

Message from the Chief Public Health Officer 2

Executive Summary 3

Introduction 5

What is Cancer and What are Risk Factors for Cancer? 5

The NWT Cancer Registry 6

Scope of the Report 7

Confidentiality 8

Cautions on Interpretation 8

Cancer Incidence 9

Crude Incidence 9

Distribution of Cancer Cases by Site 10

Age-Standardized Cancer Incidence for Comparisons between NWT and Canada 11

Cancer Incidence by Community Type 13

Cancer Incidence by Ethnicity 14

Comparison to the 1990-2000 Report 15

Cancer Mortality 16

Mortality Trends 17

Mortality by Cancer Type 18

Mortality by Community Type 18

Age-Standardized Cancer Mortality for Comparison between NWT and Canada 19

Cancer Mortality by Sex and Cancer Type 19

Cancer Mortality by Ethnicity 20

Cancer Staging 21

Cancer Control and Prevention 23

Lifestyle Factors 23

Smoking 23

Nutrition 24

Body Composition & Obesity 24

Physical Activity 24

Alcohol Consumption 24

Infectious Agents 25

Hepatitis B Virus (HBV) Vaccine 25

Human Papillomavirus (HPV) Vaccine 25

Helicobacter pylori Bacteria 25

Environmental Risk Factors 25

Ultraviolet Radiation 25

Ionizing Radiation 26

Environmental Pollution 26

Early Detection and Cancer Screening 27

Colorectal Cancer Screening 28

Cervical Cancer Screening 29

Breast Cancer Screening 30

Developing a Cancer Strategy for the NWT 32

References 34

Annex 1: Methodology 36

Cancer Data Collection 36

Data Sources 37

Analysis 38

Limitations 38

Annex 2: Incidence Rate Tables 39

Tables

1 Cancer Diagnoses Among Males, NWT 2001-2010 10

2 Cancer Diagnoses Among Females, NWT 2001-2010 10

3 Most Frequent Cancer Diagnoses in Males by Community Type, NWT 2001-2010 10

4 Most Frequent Cancer Diagnoses in Females by Community Type, NWT 2001-2010 10

5 Most Frequent Cancer Diagnoses in Males by Ethnicity, NWT 2001-2010 11

6 Most Frequent Cancer Diagnoses in Females by Ethnicity, NWT 2001-2010 11

7 Most Frequent Cancer Diagnoses in Males, 1992-2000 and 2001-2010 12

8 Most Frequent Cancer Diagnoses in Females, 1992-2000 and 2001-2010 12

9 Three Most Frequent Causes of Cancer Deaths Among Males, NWT 2000-2009 18

10 Three Most Frequent Causes of Cancer Deaths Among Females, NWT 2000-2009 18

11 Data Sources Used for Analysis 37

Figures

1 New Cancer Cases by Sex, NWT 2001-2010 (N=1107) 9

2 Age-Standardized Cancer Incidence Rates by Sex, Three-Year Rolling Average, NWT 2001-2010 (N=1107)..... 9

3 Age-Standardized Cancer Incidence Rates for the NWT and Canada, 2001-2010 (N=1107)..... 11

4 Age-Standardized, Sex-Specific Incidence Rate of Colorectal, Lung, Breast, Prostate and Oral, Cancer in the NWT and Canada, 2001-2010..... 12

5 Age-standardized Cancer Incidence Rate Ratios Between Different Community Types for all Cancers Combined Among Males, NWT 2001-2010 13

6 Age-standardized Cancer Incidence Rate Ratios Between Different Community Types for all Cancers Combined Among Females, NWT 2000-2010 13

7 Age-Standardized Incidence Rate for All Cancers Combined in Males by Ethnicity, NWT 2001-2010 (n=558) ... 14

8 Age-Standardized Incidence Rate for All Cancers Combined in Females by Ethnicity, NWT 2001-2010 (n=535) . 14

9 Age-Standardized Cancer Incidence Rates by Ethnicity, NWT 2001-2010..... 15

10 Age-Standardized Cancer Incidence Rates, Three-Year Rolling Average, NWT 1992-2009..... 15

11 Causes of Death in Males, NWT 2000-2009 (n=1076)..... 16

12 Causes of Death in Females, NWT 2000-2009 (n=694)..... 16

13 Age-Standardized Cancer Mortality Rate, Three-Year Rolling Average, NWT 2000-2009 (N=810)..... 17

14 Age-Standardized Mortality Rates For All Cancers Combined, Four Years Aggregated, NWT 1990-2009 (N=810)..... 17

15 Cancer Deaths by Type in Males, NWT 2000-2009 (n=240)... 18

16 Cancer Deaths by Type in Females, NWT 2000-2009 (n=210). 18

17 NWT and Canadian Cancer Mortality Rates, 2000-2009 19

18 Age-Standardized Colorectal, Lung, Breast and Prostate Cancer Mortality in theNWT and Canada 2000-2009 19

19 Overall Age-Standardized Cancer Mortality by Ethnicity, NWT 2000-2009 (n=450) 20

20 Stage at Diagnosis for Most Frequent Cancer Types, NWT 2006-2010 (n=391) 21

21 Percentage of Eligible Adults With At Least One Cancer Screening Test, by Type of Test, NWT 2006-2012..... 27

22 Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period,NWT 2009-2012..... 28

23 Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period, by Community Type, NWT 2009-2012..... 28

24 Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period, by Ethnicity, NWT 2009-2012..... 28

25 Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period, by Age Group, NWT 2009-2012..... 29

26 Percentage of Eligible Females With At Least One Pap Test in a Two-Year Period, by Community Type, NWT 2006-2012..... 29

27 Percentage of Eligible Females With At Least One Pap Test in a Two-Year Period, by Ethnicity, NWT 2006-2012 29

28 Percentage of Eligible Females With At Least One Pap Test in a Two-Year Period, by Age Group, NWT 2006-2012..... 30

29 Percentage of Eligible Females With At Least One Mammogram in a Two-Year Period, by Community Type, NWT 2010-2012..... 30

30 Percentage of Eligible Females With At Least One Mammogram in a Two-Year Period, by Ethnicity, NWT 2010-2012..... 31

31 Percentage of Eligible Females With At Least One Mammogram in a Two-Year Period, by Age Group, NWT 2010-2012..... 31

32 Sources of Cancer Registration Data 36

Minister's Message

A priority of the 17th Legislative Assembly is to

> *'...ensure a fair and sustainable health care system by investing in prevention, education and awareness and early childhood development, enhancing addictions treatment programs using existing infrastructure, and addressing our health facilities deficit.'*

To advance this priority, the Government of the Northwest Territories requires quality information to guide planning and decision-making.

Cancer in the Northwest Territories (2001-2010) provides an essential base of information about cancer to assist with planning and priority setting. The report presents an analysis of cancer incidence and mortality within the NWT over the past decade. It provides information to help increase awareness about cancer in the NWT, and promote integration and coordination of services for cancer prevention, screening, treatment and support services.

This report will set the direction for the Department of Health and Social Services' first *NWT Cancer Strategy*. The *Strategy*, to be completed in 2014, will be aimed at increasing understanding and awareness of all aspects of the cancer journey, will encourage greater participation in cancer screening programs, and will work towards culturally-appropriate support to cancer patients and their families.

Other initiatives within the Department will complement this work, including the partnership with NWT communities to implement wellness plans that will help each unique community achieve healthy lifestyles and thereby reduce the risk of cancer.

Together, we can achieve better health and better care for a better future.

Glen Abernethy
Minister of Health and Social Services

Message from the Chief Public Health Officer

Cancer is an increasing concern for residents of the Northwest Territories. Our residents want answers about why cancer is affecting their family, friends, and communities. Cancer arises in many forms with multiple potential causes.

Cancer in the Northwest Territories (2001-2010) contains valuable information about cancer trends in the NWT. The report profiles 10 years of information about cancer incidence and mortality in the NWT, compared to earlier reports and the rest of Canada.

The value of this report is multifaceted. It will assist health care providers and program planners when coordinating support services such as early detection and treatment. It is also a valuable resource for community leaders, policy makers, and the general public. But above all, it is about providing information that can be used to improve the lives of NWT residents and lessen the burden of cancer on their families, friends, and communities.

Findings in the report indicate there is no overall increased risk of developing cancer among NWT residents, compared to the rest of Canada. Aging of the population remains the most significant contributor to the noted rise in the numbers of people diagnosed with cancer annually. Lung, colorectal, breast and prostate are the most common cancers reported in the NWT. Fully a quarter of all cancer deaths are due to lung cancer, which also happens to be one of the most preventable forms of cancer.

Prevention and early detection are the keys to improving our outcomes. The evidence in the report reinforces our view that greater emphasis is warranted for education and prevention of modifiable risk factors for cancer; namely quitting smoking, moderate alcohol consumption, eating healthy, being physically active, and maintaining a healthy weight. Regular participation in screening programs for cervical, colorectal and breast cancers will improve early detection rates and increase survivorship. Choosing to live a healthy lifestyle, and taking an active role in our own preventative health care, will go a long way in improving our wellbeing and reducing our risk of dying from cancer.

The Department remains committed to high standards of data management with ongoing improvements in the reporting processes so that we can continue to make informed, evidence-based decisions which drive policies and programming.

Dr. André Corriveau
Chief Public Health Officer

Executive Summary

Cancer in the Northwest Territories (2001-2010) profiles cancer in the Northwest Territories (NWT) between 2001 and 2010. The main objective of the report is to describe cancer incidence and cancer mortality within the NWT population and compare these rates to Canadian figures. For both incidence* and mortality, this report conveys the most up to date information available at the time of writing, as the time necessary to identify, confirm and stage cancer information means that there is a delay of several years while cancer data is prepared for analysis. Since the annual number of cancer cases and deaths is relatively small in statistical terms, 10 years of cancer data were aggregated in order to create more stable rates and produce meaningful statistical analysis and interpretation.

Cancer in the Northwest Territories (2001-2010) is a technical report, meant as an information resource that should prove useful to a wide range of individuals with an interest in understanding cancer in the NWT. While written primarily for health care providers and program planners, it can also inform policy makers, community leaders and interested members of the public. Information presented in this report provides an important base to inform communications and dialogue for integrating and coordinating services for cancer prevention, screening, treatment and support services.

Key Findings

- On average, 111 new cancer cases were diagnosed each year.
- Cancer occurs more frequently in aging populations. When the aging of our population is taken into account, cancer incidence rates in the NWT have increased very little over this 10-year period.
- Overall, the risk of developing cancer among NWT residents is the same as that in the Canadian population as a whole.
- For all cancer types combined, there were no differences observed in incidence between males or females, between Aboriginal or Non-Aboriginal populations, or between the four ethnicity categories (Dene, Inuit, Métis and Non-Aboriginal).

Cancer in Males

- The age-standardized incidence rate for all cancers combined was lower for males in the NWT when compared to Canada.
- The most frequent cancer types in males were prostate (22% of all cancers), colorectal (21%), and lung (13%), which together account for slightly more than half of all new cancer diagnoses in males.
- When cancer types were analysed separately, the incidence of colorectal cancer was 1.6 times higher in NWT males compared to Canadian males.
- The incidence of prostate cancer was 24% lower in NWT males than in Canadian males.
- No significant differences in incidence rates between the NWT and Canada were observed for lung and oral cancers in males.

Cancer in Females

- The age-standardized incidence rate for all cancers combined was marginally increased for NWT females compared to Canadian females.
- The most frequent cancer diagnoses by site were breast (33%), colorectal (18%) and lung (12%); these three accounted for 64% of all new cancer diagnoses in females.
- When cancer types were analysed separately, colorectal cancer incidence was approximately double the rate among Canadian females.
- Breast and lung cancer incidence in the NWT were not significantly different compared to Canadian females.

* Cancer incidence signifies the number of new cancer cases diagnosed within a specified period. This differs from cancer prevalence, which indicates the number of people that have cancer at a given point in time.

Cancer Mortality

- Cancer was the leading cause of death in the NWT from 2000-2009,* accounting for 25% of all deaths for males and females combined.
- Cancer accounted for 22% of all male deaths and 30% of female deaths.
- On average, 45 cancer-related deaths occurred every year.
- Lung cancer accounted for 25% of all cancer deaths, despite accounting for only one in seven new cancer diagnoses.
- Colorectal cancer was the second most common cause of cancer-related death, followed by breast and prostate cancers.
- When age-standardized mortality rates were compared, males in the NWT had a significantly lower rate of cancer mortality from all cancers combined relative to mortality among Canadian males.
- There were no differences in the cancer mortality rates for all cancers combined among females.
- Mortality from colorectal cancer among NWT males was nearly double the rate for Canadian males. No site specific significant differences in cancer mortality were identified when compared to the national average for lung and prostate cancers.
- Age-standardized lung cancer mortality among NWT females was 1.5 times the rate for Canada.
- Colorectal cancer mortality among NWT females was double the rate for Canada.
- No differences were observed for breast cancer mortality among NWT and Canadian females.
- Mortality from all cancers combined among Dene people was 1.5 times higher than for Non-Aboriginal people in the NWT.

Early Cancer Detection

- Cancers diagnosed in earlier stages, namely Stage 1 and Stage 2, are easier to treat and have better treatment outcomes than advanced cancers in Stages 3 and 4.**
- 50% of 124 cases of colorectal cancer with staging information were diagnosed in either Stage 3 or Stage 4. This is greater than in Manitoba, the province with the most available staging data, where 46.4% of colorectal cancers diagnosed in 2009 were in Stage 3 or 4.
- 41% of the 70 lung cancer cases in the NWT with staging information were diagnosed in Stage 4. This corresponds with values reported from Manitoba, where 44% of lung cancers from 2009 were diagnosed in Stage 4.
- In the NWT, 78% of breast cancers are detected in Stage 1 or 2. These figures are comparable to Manitoba, where 80% of breast cancers diagnosed in 2009 were in Stage 1 or 2.
- 61% of the 64 cases of prostate cancer in the NWT were diagnosed in Stage 2. Compared to Manitoba, where 74% of prostate cancers were diagnosed in Stage 2, NWT could improve upon the detection for prostate cancer.

Cancer Screening

Regular screening of at-risk but seemingly healthy individuals within the population is one of several strategies for improving early detection. In the NWT, there are three routine screening programs in place: mammography for breast cancer, Pap tests for cervical cancer and Fecal Immunochemical Tests (FIT) for colorectal cancer screening.

Colorectal cancer screening

- Routine annual or bi-annual screening is recommended for all NWT residents over age 50.
- Approximately 20% of eligible individuals aged 50 to 74 in the NWT had one colorectal cancer screening test in 2011 and 2012.

Cervical cancer screening

- Annual or bi-annual Pap screening is recommended for all females from 21 years of age or three years after sexual initiation, whichever comes earliest, until age 69.
- The percentage of NWT females eligible for Pap screening who were compliant with screening recommendations was approximately 53% in 2011 and 2012.

Breast cancer screening

- Mammography is an effective tool for the early detection of breast cancer and is recommended as a screening test every two years for all females aged 50 to 69 years.
- In 2011 and 2012, 55% of eligible females aged 50-69 years underwent a mammogram.

* Cancer mortality is presented for the 2000-2009 interval because NWT mortality data for 2010 was not yet available at the time of analysis.

** Cancer staging began in 2006 with data presented for the interval from 2006 - 2010.

Introduction

Cancer in the Northwest Territories (2001-2010) profiles cancer in the Northwest Territories (NWT) over the period from 2001 to 2010. The purpose of the report is to describe cancer incidence* and mortality within the NWT population and compare the rates to Canada (2005). This report expands on the previous report, *Cancer in the Northwest Territories (1990-2000)*, by including 10 years of new data.

The renewal of the *Public Health Act* in 2009 made it mandatory, as per new *Disease Surveillance Regulations*, to report results from cancer screening tests. Since 2010, the NWT has established guidelines for cervical, colorectal and breast cancer screening. As a result, the report closely examines cancer screening, specifically data resulting from cervical, colorectal, and breast cancer screening tests.

Similar to the previous cancer report, data from the *Canadian Community Health Survey (2009/2010)*[1] were used to assess the prevalence of risk factors for cancer. Over the years, the NWT has implemented programs and policies to reduce smoking, increase physical activity, and improve nutrition. The NWT also implemented a Human Papilloma Virus (HPV) immunization program in 2009. This vaccine is the first to prevent certain types of HPV that may cause cervical cancer. Information on the HPV program and a study that investigated the prevalence of HPV in the NWT population is described in this report.

This report is meant as an information resource that should prove useful to a wide range of individuals with an interest in understanding cancer in the NWT. While written primarily for health care providers and program planners, it can also inform policy makers, community leaders, and interested members of the public. Information presented in this report provides an important base to inform communications and dialogue for integrating and coordinating services for cancer prevention, screening, treatment, and support services.

What is Cancer and What are Risk Factors for Cancer?

Cancer is the uncontrolled growth of cells in the body. Normally, the immune system can recognize abnormal cells and destroy them. However, if cancer cells bypass this defence mechanism they can multiply and form a tumour.

The occurrence of cancer is often associated with specific risk factors. Several risk factors can be associated with the development of cancer, and there may be different risk factors for different types of cancers. Our genetics, considered internal risk factors, can also play a role; individuals who have a family history of the disease can be at greater risk. Though genetic testing can be used to identify some genetic risk factors, these genes cannot be altered and greater emphasis is therefore placed on prevention and early detection.

More commonly, cancer results from exposure to external substances (ie. cigarette smoke, radiation, some infectious agents, etc.). Obesity is also documented as a risk for certain types of cancer. Whereas the above exposures increase a person's chance of getting cancer, a healthy diet and physical activity can be protective against cancer.

It is important to keep in mind that exposure to risk factors does not necessarily mean a person will get the disease. Likewise, a person who practices prevention cannot guarantee the absence of disease; it only decreases the likelihood. In most cases, the specific cause of cancer in an individual is unknown, especially when exposed to several risk factors. In addition, cancer often develops, or is diagnosed, many years after exposure to risk factors. This makes it especially challenging to attribute the cancer to a specific factor.

* Cancer incidence signifies the number of new cancer cases diagnosed within a specified period. This differs from cancer prevalence, which indicates the number of people that have cancer at a given point in time.

The NWT Cancer Registry

Mandatory reporting of cancer in the NWT began in 1990. Data on cancer in the NWT is available from the 1960s onward, but prior to 1990 cancer information was pieced together from a variety of sources, notably death certificates and information from cancer registries in provinces where NWT residents were treated for cancer.

For the purpose of national reporting, NWT data prior to 1992 were sent to the National Cancer Incidence Reporting System administered by Statistics Canada. This system did not link cases at a national level, creating the possibility for patients to be registered in more than one jurisdiction.

The NWT Cancer Registry was established alongside the Canadian Cancer Registry in 1992. As a 'person-oriented' system, this national registry ensures that individuals are registered only in the jurisdiction of residence at the time of diagnosis. This system improves the ability to report accurately, through record linkage at the national level and feedback to the contributing provincial/territorial registries. Registered cancers may be deleted from the NWT Registry in instances where a tumour was first diagnosed when an individual was living in another province (i.e. before they resided in the NWT). Conversely, unreported cases of cancer among NWT residents that may have been diagnosed and registered elsewhere can be added to the NWT Registry.

The Department of Health and Social Services administers the NWT Cancer Registry. Under authority from the *Disease Surveillance Regulations*, this population-based registry records all newly diagnosed cases of invasive cancer, as well as selected benign tumours and carcinoma *in situ*.* The main purpose of the Registry is for cancer epidemiology and surveillance: to collect, review and analyze cancer data in order to describe cancer incidence, prevalence, morbidity and mortality in the NWT population. The Registry does not collect information on treatment or prognosis of individuals diagnosed with cancer. Data collected are submitted annually to the Canadian Cancer Registry.

* Invasive cancers are malignant tumours that tend to invade and destroy nearby tissue and spread to other parts of the body. Benign tumours do not invade nearby tissue or spread to other parts of the body. *In situ* cancers are confined to the point of origin and have not spread.

Scope of the Report

This report conveys the most up to date information available at the time of writing for both cancer incidence and cancer mortality. Since the annual number of cancer cases and deaths is relatively small in statistical terms, 10 years of cancer data were aggregated in order to produce more stable rates and allow for more meaningful statistical analysis and interpretation.

Information on cancer patterns in the NWT is based on data extracted from the Canadian Cancer Registry (2001-2010) and the NWT Vital Statistics Registry (2000-2009). These were compared to national level cancer rates from the mid-point year, 2005, obtained from the following sources: Canadian Cancer Statistics Manual (2005 and 2012) for cancer types, and Statistics Canada's Canadian Socioeconomic Information Management (CANSIM) tables for geographic jurisdictions.

Accurate reporting of cancers is especially important in the NWT. Cancer statistics in jurisdictions with small populations, like the NWT, are very sensitive to small changes in the number of cases. The methodology used in the preparation and analysis of the NWT data reflects these considerations (see Annex 1).

In this report, a cancer 'case' represents a malignant tumour while a cancer 'site' is the tissue or organ of origin for the tumour. The analyses in this report do not include benign tumours and carcinoma *in situ*, focusing instead only on invasive cancers. In addition, secondary tumours that result from the spreading of cancer to other organs are not considered to be 'cases.' However, it is possible for a person to have more than one malignant tumour (i.e. cancers unrelated to each other). In this instance, each tumour is registered and counted as a separate 'case.'

Cancer incidence and mortality data are presented by sex, community type, and ethnicity. The most prevalent cancers are identified for each group and compared to sex-specific national rates. The NWT Cancer Registry includes cancers diagnosed only in permanent residents of the NWT. Thus, people from the NWT who were residing elsewhere at the time of their diagnosis were not included in the cancer incidence analyses. All confidence intervals shown around data points are 95% confidence intervals.

Community type refers to the place of permanent residence at the time of cancer diagnosis or death. For comparison purposes, the groupings are: Yellowknife, Regional Centres (Hay River, Fort Smith and Inuvik), and Smaller Communities (all remaining communities in the NWT).

Cancer incidence and mortality rates among Aboriginal and Non-Aboriginal populations are compared. Where numbers permit, ethnicity is further categorized into Dene, Inuit, Métis, and Non-Aboriginal groupings. For statistical validity, this analysis is presented only when the number of new cases of cancer within any ethnic group exceeded 25 cases in the 10-year period.

Cancer mortality data were derived from the NWT Vital Statistics Registry. The cancer mortality analyses include all individuals who were permanent NWT residents at the time of their death from cancer. Individuals are included regardless of whether they were residing out of territory at the time of diagnosis or if they died in an out-of-territory hospital or long-term care facility.

The risk of developing cancer increases with age. Cancers become more prevalent as the NWT population ages and the number of senior citizens grows, increasing the disease burden on society and the health care system. Age-standardized rates were used to eliminate the effect of differences in age distribution when comparing the NWT and Canada populations.[*,2]

* Age-standardization to the 1991 Canadian population was performed. The 1991 population standard was used to calculate age-standardized rates in the Canadian Cancer Statistics Manual.

This report also examines various interventions for cancer control. Cancer control focuses on the prevention, early detection, and treatment of cancer by converting the knowledge gained through research, surveillance, and outcome evaluation into strategies and actions. This report describes the various risk factors for cancer and ways to reduce risks. NWT residents and Canadians are compared with regard to risk factors and protective behaviours. Data measuring health or risk behaviours are primarily derived from the *Canadian Community Health Survey 2009/2010*. Unless otherwise stated, these statistics are limited to individuals 12 years of age and older. Cancer screening, which allows for early detection and thus early treatment, is another strategy for reducing cancer mortality. Participation rates from NWT's screening programs for breast, cervical, and colorectal cancers are presented in this report.

Confidentiality

The *NWT Public Health Act* dictates the safeguarding of confidentiality of persons whose cancers are reported to the Registry. Data in this report are presented in such a way as to prevent the identification of individuals with cancer. For this reason, cells with five or fewer cases, which can occur for rare cancers and when stratifying (e.g. by age, sex, community size or ethnicity) have been suppressed from presentation.

Cautions on Interpretation

The validity of rates in this report depends on the completeness of cancer reporting and accuracy of population estimates. Incidence data are based on cases of primary cancer diagnosed between January 1, 2001, and December 31, 2010 that were reported in time to be included in the annual cancer registry data release in the spring of 2013. Additional cancers from 2001-2010 not reported in time for the 2013 data release will be included in subsequent reports. Population estimates are also subject to periodic revision. For these reasons, rates in this report may not necessarily correspond with information reported elsewhere that covers this time period.

Many of the rates presented in this report have a large degree of associated variability, due to the small numbers of cancer cases and deaths. For example, as cancer cases and deaths are further categorized by sex, community type and ethnicity, the numbers in each sub-category drop sharply, resulting in increasingly imprecise rates for the smallest groups. When examining rates, the reader is cautioned to consider the number of cases upon which the estimate is based.

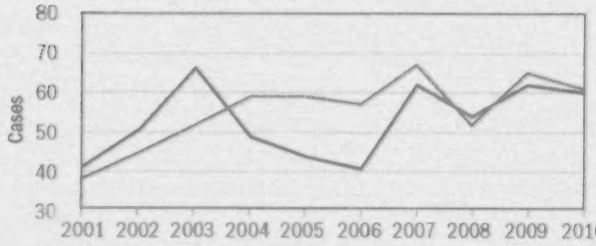
Cancer Incidence

Crude Incidence

In total, 1107 cases of cancer were diagnosed among NWT residents between 2001 and 2010. An average of 111 new cancer cases were diagnosed each year. The annual number of cases varied between 40 to 68 cancer cases for males and 43 to 67 for females (Figure 1).

While the trend of new cases appears to have increased for both genders, this may simply reflect an increase in the size of the population or changes in the age distribution of NWT residents. Since cancer disproportionately affects older populations, as the population in the NWT becomes older it is expected that there will be more cases of cancer diagnosed. To account for changes in population size and aging populations, an analysis measuring age-standardized incidence rates is more appropriate. When these variables are taken into account, cancer rates in the NWT have increased very little over this 10-year period (Figure 2). Small increases in rates may be due to early diagnosis and advances in diagnostic technology rather than to a true increase in cancer cases. Nationally, cancer incidence rates are higher in males. There were no significant differences between cancer rates in NWT males and females.

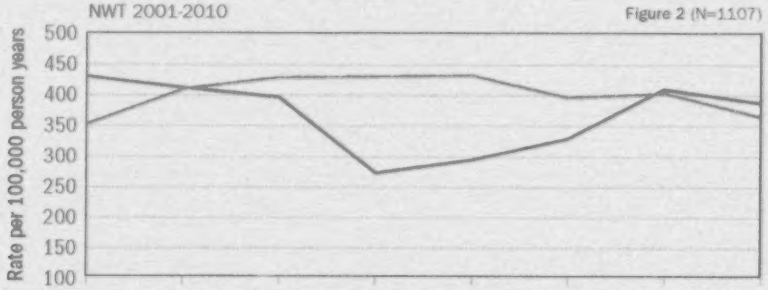
New Cancer Cases by Sex
NWT 2001-2010
Figure 1 (N=1107)*



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Male	40	46	53	60	60	58	68	53	66	62
Female	43	52	67	50	45	42	63	55	63	61

* 'N' refers to the total size of the population. In this case, 1107 represents the number of new cases of cancer in the specified interval. When representing a sample of the population, as in by sex, community type or ethinicity, the notation "n" is used. This notation is used throughout the report.

Age-Standardized Cancer Incidence Rate by Sex, Three-Year Rolling Average
NWT 2001-2010
Figure 2 (N=1107)



	2001-03	2002-04	2003-05	2004-06	2005-07	2006-08	2007-09	2008-10
Male	358.2	411.4	431.9	432.3	435.5	397.2	407.2	367.7
Female	431.7	413.1	398.9	278.6	300.8	334.7	411.4	390.8

Distribution of Cancer Cases by Site

Between 2001 and 2010, the most frequent cancer diagnoses by site or type in males were prostate (22%), colorectal (21%), and lung (13%) (Table 1). These three cancer types accounted for 57% of all new cancer diagnoses in males. In females, the most frequent cancer diagnoses reported by site were breast (33%), colorectal (18%) and lung (12%) (Table 2). These three cancer types accounted for 64% of all new cancer diagnoses in females.

Cancer diagnoses by community type were also examined. The small population size of most NWT communities does not allow for the comparison of rates at the community level. Groupings by community type have become the standard for statistical analysis in the NWT, the rationale being that communities within each of these groupings tend to have similar socio-demographic characteristics.

Cancer diagnoses were aggregated into three community type groupings: Yellowknife, Regional Centres (Hay River, Fort Smith, and Inuvik), and Smaller Communities (all remaining NWT communities). Prostate, colorectal, and lung cancer in males; and breast, colorectal, and lung in females; were consistently the most frequently diagnosed cancers, regardless of community type (Table 3 and Table 4). The relative ranking of these most frequent cancers was different between Yellowknife, Regional Centres and Small Communities.

Cancer Diagnoses Among Males

NWT 2001-2010 — Table 1

Cancer Type	Total	Proportion of All Cases (%)
Prostate	126	22.3
Colorectal	118	20.8
Lung	75	13.3
Oral	36	6.4
Non-Hodgkin's Lymphoma	25	4.4
Pancreatic	18	3.2
Leukemia	18	3.2
Bladder	17	3.0
Kidney	16	2.8
Other	117	20.6
Total: All Types	**566**	**100.0**

Cancer Diagnoses Among Females

NWT 2001-2010 — Table 2

Cancer Type	Total	Proportion of All Cases (%)
Breast	179	33.1
Colorectal	99	18.3
Lung	66	12.2
Thyroid	19	3.5
Uterine	19	3.5
Non-Hodgkin's Lymphoma	17	3.1
Cervical	15	2.8
Kidney	11	2.0
Stomach	11	2.0
Melanoma	11	2.0
Other	94	17.5
Total: All Types	**541**	**100.0**

Most Frequent Cancer Diagnoses in Males by Community Type

NWT 2001-2010 — Table 3

	Rank		
	1	2	3
Yellowknife (n=203)	Prostate (25%)	Colorectal (16%)	Lung (9%)
Regional Centres (n=162)	Prostate (22%)	Colorectal (22%)	Lung (14%)
Small Communities (n=196)	Colorectal (26%)	Lung (19%)	Prostate (17%)

Most Frequent Cancer Diagnoses in Females by Community Type

NWT 2001-2010 — Table 4

	Rank		
	1	2	3
Yellowknife (n=199)	Breast (38%)	Colorectal (15%)	Lung (9%)
Regional Centres (n=157)	Breast (38%)	Colorectal (17%)	Lung (10%)
Small Communities (n=179)	Colorectal (23%)	Breast (23%)	Lung (18%)

Cancer diagnoses by ethnicity were compared. In males, the most frequent cancer diagnosis was colorectal cancer in Dene and Inuit males, while prostate cancer was the most frequent cancer diagnosis in Métis and Non-Aboriginal populations (Table 5). Among females, breast cancer was the most frequent cancer diagnosis in Métis and Non-Aboriginal females, while colorectal cancer was the most frequent cancer diagnosed in Dene females, and lung cancer was the most frequent cancer diagnosed in Inuit females (Table 6).

Most Frequent Cancer Diagnoses in Males by Ethnicity

NWT 2001-2010 — Table 5

	Rank		
	1	2	3
Dene (n=169)	Colorectal (33%)	Prostate (17%)	Lung (16%)
Inuit (n=45)	Colorectal (22%)	Prostate (16%)	Lung (13%)
Métis (n=49)	Prostate (20%)	Lung (16%)	Colorectal (14%)
Non-Aboriginal (n=295)	Prostate (26%)	Lung (16%)	Colorectal (12%)

Most Frequent Cancer Diagnoses in Females by Ethnicity

NWT 2001-2010 — Table 6

	Rank		
	1	2	3
Dene (n=204)	Colorectal (28%)	Breast (25%)	Lung (15%)
Inuit (n=51)	Lung (26%)	Breast (24%)	Colorectal (18%)
Métis (n=37)	Breast (43%)	Colorectal (19%)	Lung/Thyroid (5%)
Non-Aboriginal (n=243)	Breast (40%)	Colorectal (11%)	Lung (8%)

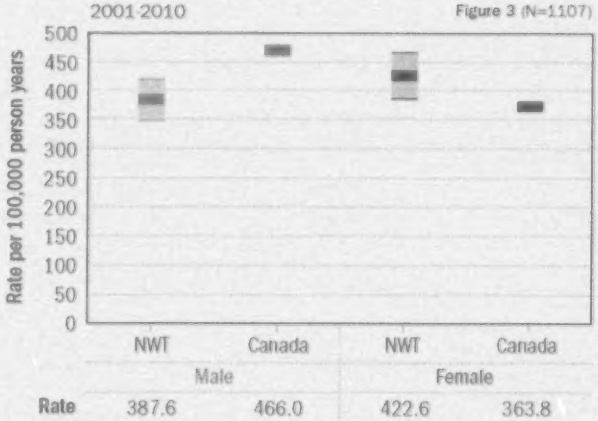
Age-Standardized Cancer Incidence for Comparisons between NWT and Canada

While crude incidence rates are important for measuring the burden of cancer on the health care system, crude rates are not appropriate for comparing between geographic regions. Since cancer preferentially affects older people, and the population in the NWT is younger than elsewhere in Canada, it is not unexpected that both male and female crude incidence rates in the NWT would be significantly lower when compared to Canada. Age-standardized rates, namely those controlling for differences in population structure, show that when compared to the overall Canadian population, the risk for developing cancer in NWT females was higher whereas it was lower for NWT males (Figure 3).

Due to small numbers, analysis could only be performed on the four most frequently diagnosed cancer types in males (colorectal, prostate, lung and oral) and the three most frequently diagnosed cancer types in females (breast, colorectal and lung).

Age-Standardized Cancer Incidence Rates* for the NWT and Canada

2001-2010 — Figure 3 (N=1107)



* Rates are adjusted for age using the indirect method of standardization and the 1991 Canadian Population as the reference population. Tests for statistical significance and confidence intervals were calculated assuming the Poisson distribution and a p-value of less than 0.05.

NWT cancer rates were also compared to Canadian rates by cancer type (Figure 4). The rate of colorectal cancer was statistically higher in males and females from the NWT.* The age-standardized incidence rate of colorectal cancer over the 2001 to 2010 period was 1.6 times the rate in the general Canadian population. For females, the rate was approximately 2 times the rate seen in Canadian females overall. Prostate cancer incidence was 24% lower among NWT males than Canadian males. Significant differences in incidence rates in the NWT and Canada were not observed for lung and oral cancers in males. The age-standardized incidence of lung cancer appears to be higher among NWT females relative to Canadian females; however, this finding is not statistically significant. The age-standardized incidence of breast cancer in the NWT was not significantly different from the incidence within the general female Canadian population.

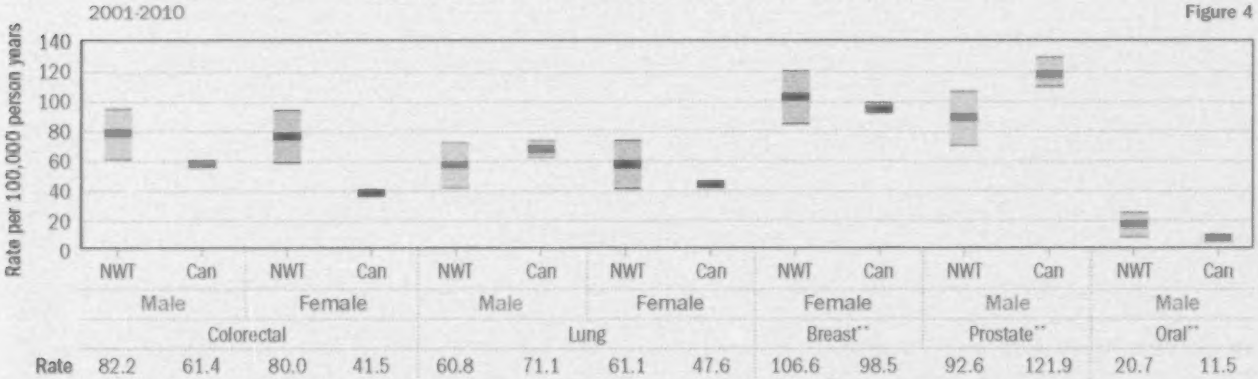
Age-standardized incidence rates for the most common cancer types were further investigated from the last two decades. Few significant differences between the most recent and previous decade were observed (Table 7 and Table 8). In males and females, the three most frequently diagnosed cancers were similar in the 1990-2000 and 2001-2010 decades: lung, colorectal, and breast or prostate. The important exception was the fact that prostate cancer has surpassed lung cancer to become the most common cancer in males. From 1990 to 2000, prostate cancer accounted for 11.4% of new cancer diagnoses, whereas in the 2001 to 2010 interval, prostate cancer accounted for 22.4% of new cancer diagnoses among males. Among females, breast, colorectal and lung cancer rates remained constant throughout both decades as the most common cancer types.

Both the 1992-2000 and 2001-2010 cancer data identify that colorectal cancer rates in both males and females in the NWT were higher than in Canada, and that lung cancer rates were higher in females in the NWT than in Canada.

Age-Standardized, Sex-Specific Incidence Rate of Colorectal, Lung, Breast, Prostate and Oral Cancer in the NWT and Canada

2001-2010

Figure 4



** Breast cancer rates are only reported for females. Prostate cancer rates are only reported for males. Oral cancer rates are only reported for males.

Most Frequent Cancer Diagnoses in Males

1992-2000 and 2001-2010

Table 7

Type	1992-2000	2001-2010
Colorectal	22%	21%
Lung	20%	13%
Prostate	11%	22%

Most Frequent Cancer Diagnoses in Females

1992-2000 and 2001-2010

Table 8

Type	1992-2000	2001-2010
Breast	28%	33%
Colorectal	16%	18%
Lung	14%	12%

* Canadian rates used for this comparison were the 2005 rates reported in the 2012 Canadian Cancer Statistics publication. The extremes in the range of values from 2000-2009 were used as the 'confidence interval'.

Cancer Incidence by Community Type

Comparative analysis of cancer incidence in different community types using age-standardized rate ratios was performed to determine whether incidence rates differed among community groupings. Incidence rates from each community type were compared to each other, as well as to the general NWT and Canadian populations.

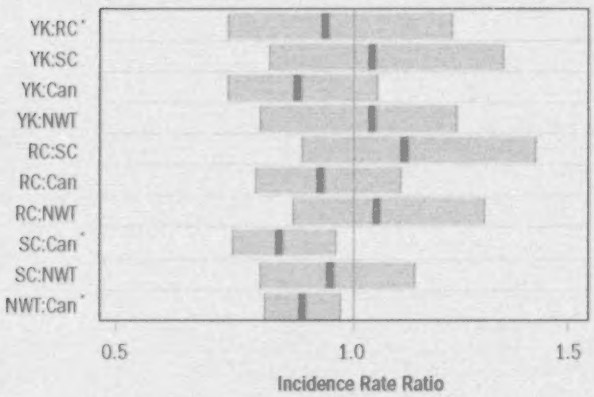
For all cancers combined, males living in Small Communities had a 20% lower rate of new cancer diagnoses than Canadian males. Similarly, males in the NWT had about a 15% lower rate of all cancers. No other comparisons of incidence in males by community type showed statistically significant differences (Figure 5).

A similar analysis of all cancers among females showed a significant difference between Yellowknife and the Regional Centres. In this case, the overall rate of new cancers in Yellowknife was approximately 30% lower than the incidence rate in the Regional Centres (Figure 6). No other significant differences were detected among females when compared by community type.

The difference between incidence rates in the two community types being compared lessens as the ratio approaches 1.0. If a 95% confidence interval for the incidence rate ratio includes 1.0, the two rates are not statistically different from each other. However, if the 95% confidence interval does not include 1.0, the rates are significantly different. This means that the two community types differ with respect to the incidence of cancer.

Age-standardized Cancer Incidence Rate Ratios Between Different Community Types for All Cancers Combined Among Males

NWT 2001-2010 Figure 5

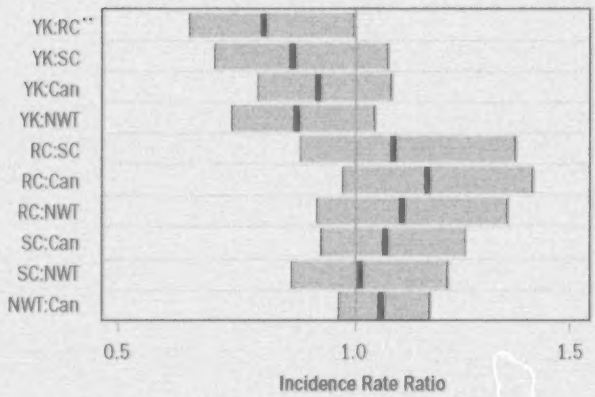


* Significant differences observed for Small Communities relative to Canada and the Northwest Territories relative to Canada.

YK = Yellowknife
RC = Regional Centres
SC = Small Communities
NWT = All Northwest Territories
Can = All Canada

Age-standardized Cancer Incidence Rate Ratios Between Different Community Types for All Cancers Combined Among Females

NWT 2001-2010 Figure 6



** Significant differences observed for Yellowknife relative to Regional Centres.

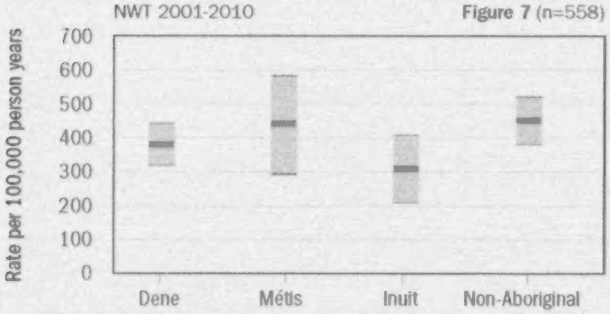
YK = Yellowknife
RC = Regional Centres
SC = Small Communities
NWT = All Northwest Territories
Can = All Canada

Cancer Incidence by Ethnicity

Approximately half of all cancers diagnosed in the NWT between 2001 and 2010 were among Aboriginal persons, a reflection of the fact that approximately half of the population is Aboriginal. For all cancer types combined, there were no differences observed in incidence among males or females between Aboriginal or Non-Aboriginal populations or between the four ethnicity categories (Dene, Inuit, Métis and Non-Aboriginal) (Figure 7 and Figure 8).

Age-Standardized Incidence Rate for All Cancers Combined in Males by Ethnicity

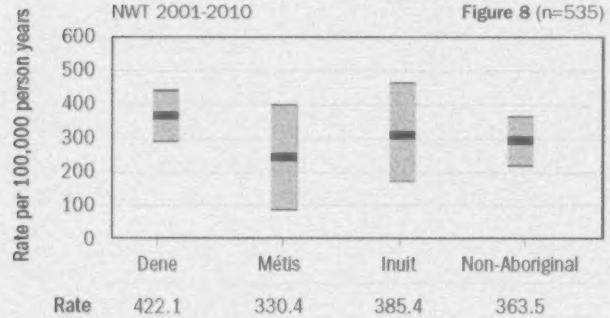
NWT 2001-2010 **Figure 7** (n=558)



	Dene	Métis	Inuit	Non-Aboriginal
Rate	393.6	451.1	320.3	464.9

Age-Standardized Incidence Rate for All Cancers Combined in Females by Ethnicity

NWT 2001-2010 **Figure 8** (n=535)



	Dene	Métis	Inuit	Non-Aboriginal
Rate	422.1	330.4	385.4	363.5

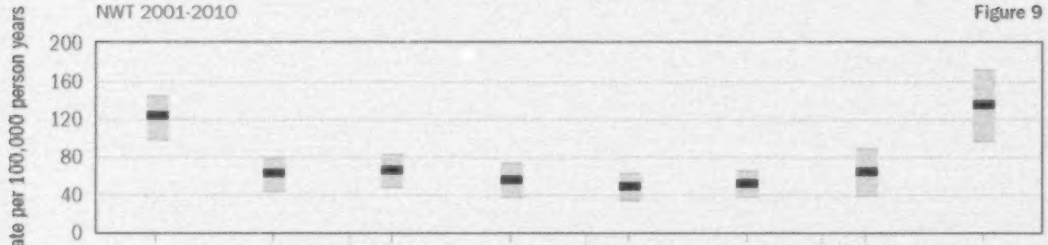
Further analyses to examine cancer types and ethnicity were limited due to the small numbers of many cancer types. There were sufficient numbers to compare only Dene and Non-Aboriginal populations. Within these groups, adequate case numbers were available to examine colorectal and prostate cancer incidence among males, and colorectal and breast cancer among females.

Colorectal cancer incidence was significantly higher among Dene compared to Non-Aboriginal people in the NWT (Figure 9). Conversely, prostate cancer incidence was significantly higher in Non-Aboriginal males compared to Dene males. There was no significant difference in the rates of lung or breast cancer between Dene and Non-Aboriginal people in the NWT.

Case counts for Métis and Inuit populations were too small to provide age-standardized rates

Age-Standardized Cancer Incidence Rates by Ethnicity
NWT 2001-2010

Figure 9



	Colorectal		Lung		Breast*		Prostate*	
	Dene	Non-Aboriginal	Dene	Non-Aboriginal	Dene	Non-Aboriginal	Dene	Non-Aboriginal
Rate	123.8	63.4	67.2	57.2	50.0	53.2	65.7	137.3

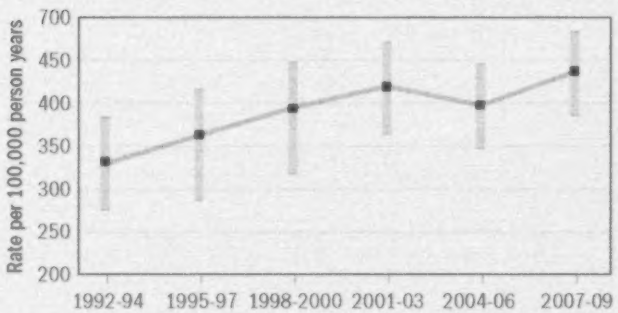
* Breast cancer rates are only reported in females. Prostate cancer rates are only reported for males.

Comparison to the 1990-2000 Report

Between 2000 and 2010, the average number of new cancer cases was 111 per year, compared to an average of 75 new cancer cases reported in the previous 10-year report. The age-standardized incidence rates since 1992 show an increasing trend (Figure 10). The cancer incidence rate from the 2007-09 interval was significantly higher than the rate from the 1992-94 period.

Age-Standardized Cancer Incidence Rates, Three-Year Rolling Average
NWT 1992-2009

Figure 10 (N=1660)



	1992-94	1995-97	1998-2000	2001-03	2004-06	2007-09
Rate	326.6	359.1	390.6	414.8	393.5	432.1

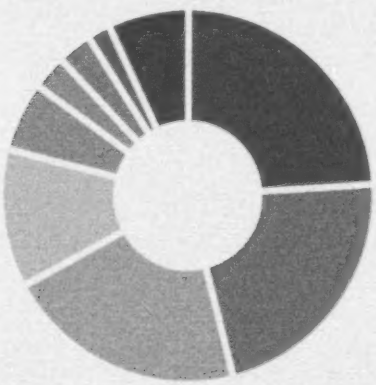
Cancer Mortality

Cancer was the leading cause of death in the NWT from 2000-2009, accounting for 25% of all the deaths in the territory. Cancer accounted for 22% of all male deaths between 2000 and 2009, second only to circulatory causes (eg., heart failure and strokes) (Figure 11). In females, cancer accounted for 30% of all deaths (Figure 12). Cancer was also the leading cause of death Canada-wide from 2000-2009.[2]

Causes of Death in Males

NWT 2000-2009

Figure 11 (n=1076)

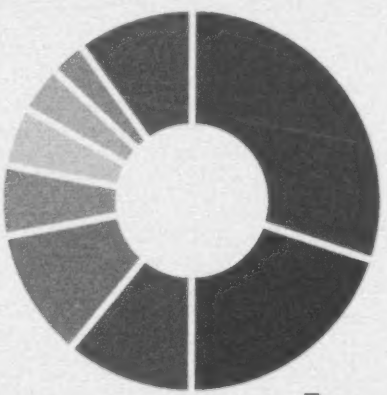


24%	Circulatory
22%	Cancer
21%	Injuries
12%	Respiratory
6%	Abnormal Clinical Findings
3%	Digestive
3%	Nervous
2%	Endocrine/Metabolic
7%	Other

Causes of Death in Females

NWT 2000-2009

Figure 12 (n=694)



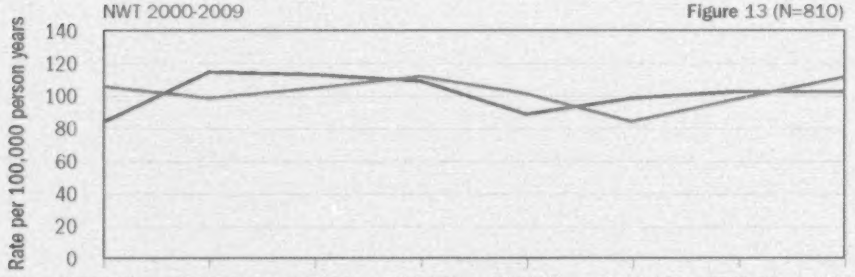
30%	Cancer
20%	Circulatory
11%	Respiratory
11%	Injuries
6%	Abnormal Clinical Findings
5%	Digestive
4%	Mental Behavioural
3%	Infectious Disease
10%	Other

Mortality Trends

During the 2000-2009 decade, there was an average of 45 cancer-related deaths yearly among NWT residents for all cancers combined. Among males, the annual number of cancer deaths ranged from 17 to 34; whereas among females, the average number of cancer deaths ranged from 14 to 35. Despite the wide variation in the number of cases per year, the overall number of cases and the trend did not change significantly over the 10-year period covered in this report. The three-year rolling average of cancer death rates shows a relatively stable trend over the decade from 2000 to 2009, despite considerable variation from year to year (Figure 13).

Age-Standardized Cancer Mortality Rate, Three-Year Rolling Average

NWT 2000-2009 **Figure 13** (N=810)



	2000-02	2001-03	2002-04	2003-05	2004-06	2005-07	2006-08	2007-09
Male	109	102	107	115	104	87	100	114
Female	88	117	116	111	91	101	105	105

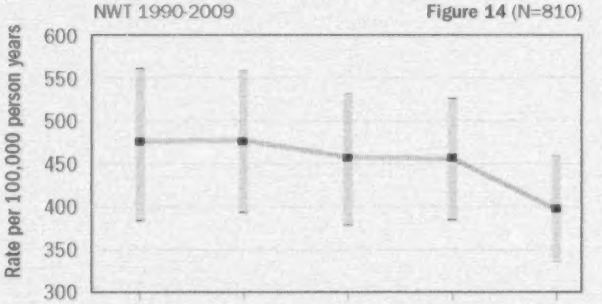
While the incidence of all cancers combined has been increasing since 1992, mortality from all cancers combined has been decreasing. However, the error margins from the estimates were too wide to definitively state that there was a decreasing trend in cancer mortality (Figure 14).

Over the past 20 years, lung, colorectal, breast and prostate cancers have remained the most frequent causes of cancer death in the NWT. The proportion of cancer deaths attributable to the four most common cancers has changed minimally between the two 10-year reporting periods. In 2001-2010, 10% fewer lung cancer deaths among males were observed, however colorectal cancer deaths increased by 6%. For females, mortality from any individual cancer did not change more than 5%.

During the 1990-2000 period, NWT females were observed to have higher colorectal and lung cancer mortality compared to Canadian females. Moving forward to 2001-2010, mortality for females is similarly high relative to the Canadian average. NWT males were also observed to have increases in mortality from lung and colorectal cancer compared to Canadian males.

Age-Standardized Mortality Rates For All Cancers Combined, Four Years Aggregated

NWT 1990-2009 **Figure 14** (N=810)



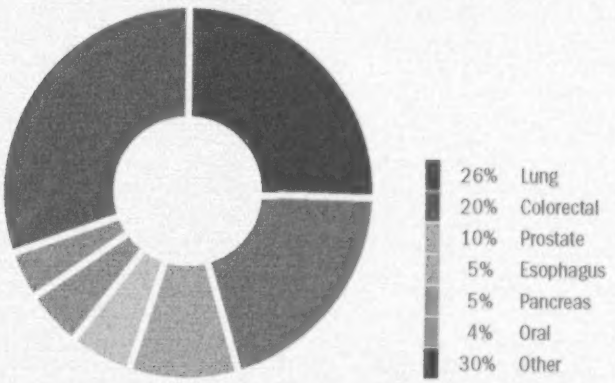
	1990-93	1994-97	1998-2001	2002-05	2006-09
Rate	470.9	473.4	453.7	452.5	394.4

Mortality by Cancer Type

A small number of cancer sites accounted for most cancer-related deaths in both males and females (Figure 15 and 16). Despite the fact that lung cancer accounted for only one in seven new cancer diagnoses, lung cancer was responsible for approximately one quarter of all cancer deaths. Colorectal cancer was the second most common cause of cancer-related deaths, followed by breast and prostate cancers. About a third of cancer deaths were caused by 'other' cancers, a category that summarizes dozens of less common cancer types.

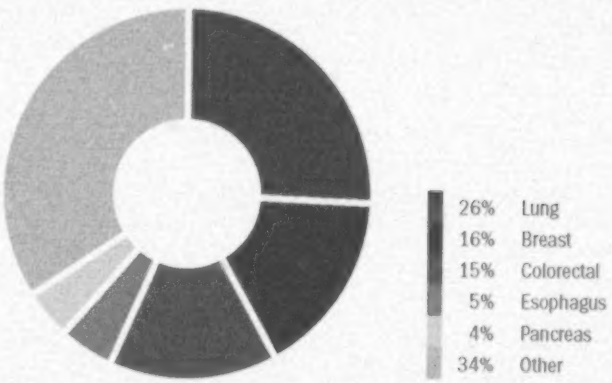
Cancer Deaths by Type in Males,
NWT 2000-2009

Figure 15 (n= 240)



Cancer Deaths by Type in Females,
NWT 2000-2009

Figure 16 (n=210)



Mortality by Community Type

The most common cancers responsible for cancer-related deaths varied only slightly between community type (Table 9 and Table 10). For males in all three community types (Yellowknife, Regional Centres, Small Communities), lung and colorectal cancers were the first and second most frequent causes of death due to cancer. The third-ranked cancer in both Regional Centres and Small Communities was prostate cancer, while in Yellowknife it was non-Hodgkin's lymphoma. In the Small Communities, lung and colorectal cancers were responsible for 57% of all cancer deaths. In Yellowknife and the Regional Centres, these same two cancers accounted for 37% and 39% of all cancer deaths, respectively.

Among females, the three most frequent cancers causing death in all community types were lung, breast and colorectal cancer. In Yellowknife and the Regional Centres, breast cancer was the cause of 22% and 25% of all female cancer deaths. Notably, breast cancer in the Small Communities only contributed to 6% of all cancer deaths.

Comparisons of sex-specific cancer death rates by community type identified that NWT males had a significantly lower overall cancer mortality rate than Canadian males. No other significant differences were observed among different community types within the NWT for males or females. Extensive investigation by cancer type among different community types could not be performed due to insufficient numbers.

Three Most Frequent Causes of Cancer Deaths Among Males

NWT 2000-2009 — Table 9

	Rank		
	1	2	3
Yellowknife (n=71)	Lung (21%)	Colorectal (16%)	Non-Hodgkin's Lymphoma (7%)
Regional Centres (n=72)	Lung (22%)	Colorectal (17%)	Prostate (15%)
Small Communities (n=94)	Lung (32%)	Colorectal (25%)	Prostate (7%)

Three Most Frequent Causes of Cancer Deaths Among Females

NWT 2000-2009 — Table 10

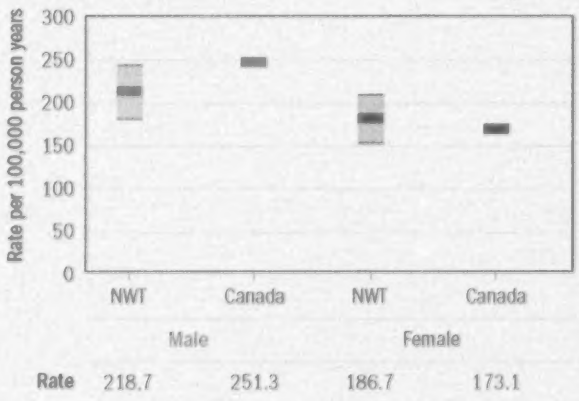
	Rank		
	1	2	3
Yellowknife (n=73)	Lung (25%)	Breast (22%)	Colorectal (10%)
Regional Centres (n=52)	Breast (25%)	Lung (23%)	Colorectal (15%)
Small Communities (n=83)	Lung (29%)	Colorectal (18%)	Breast (6%), Esophagus (6%)

Age-Standardized Cancer Mortality for Comparison between NWT and Canada

To compare NWT death rates to Canadian rates, the data needed to be age-standardized to reflect differences in the age composition of the NWT population compared to the Canadian population. Using age-standardized data, males in the NWT had a significantly lower death rate from all cancers combined relative to Canadian males. There were no differences in the death rates for all cancers combined among females (Figure 17).

NWT and Canadian Cancer Mortality Rates

2000-2009 — Figure 17



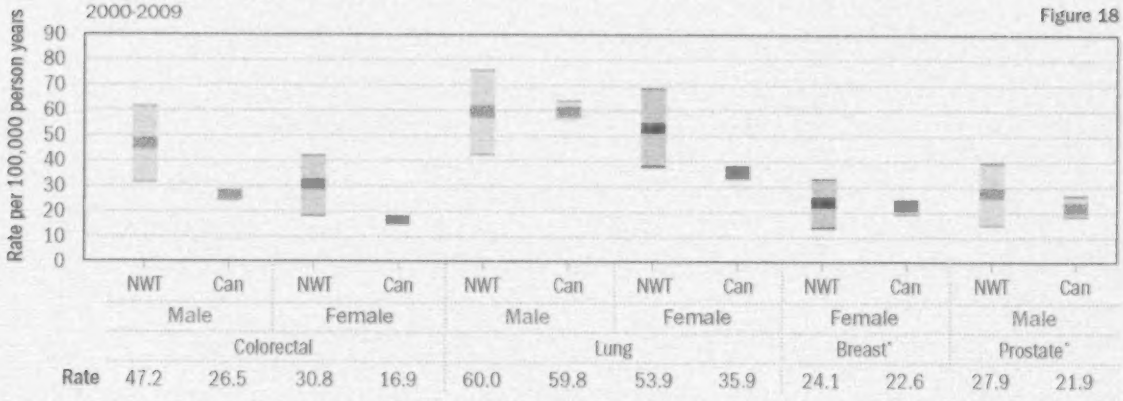
Cancer Mortality by Sex and Cancer Type

Mortality from colorectal cancer among NWT males was nearly double the rate for Canadian males (Figure 18). No significant differences in cancer deaths compared to the national average were observed among NWT males for lung and prostate cancers. Mortality rates for both lung and colorectal cancers among NWT females were higher relative to Canadian rates. Lung cancer mortality among NWT females was 1.5 times the rate among females in Canada and colorectal cancer mortality was double the rate for Canada. No differences were observed for breast cancer mortality among NWT and Canadian females.

Age-Standardized Lung, Colorectal, Prostate and Breast Cancer Mortality in the NWT and Canada

2000-2009

Figure 18



* Breast cancer rates are only reported in females. Prostate cancer rates are only reported for males.

Cancer Mortality by Ethnicity

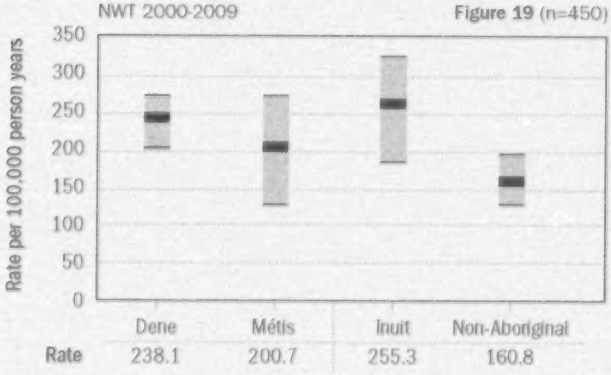
Due to small numbers, statistically valid comparisons of cancer deaths could be performed only for Dene and Non-Aboriginal ethnicities and not for Inuit and Métis. Mortality from all cancers combined for Dene people was 1.5 times higher than for Non-Aboriginal people in the NWT from 2000-2009 (Figure 19). No other significant differences between ethnicities were observed among both males and females.

Small numbers of deaths by cancer type prevented examination by ethnicity for all but colorectal and lung cancers. No significant differences were observed between the death rates for either colorectal or lung cancer between Dene and Non-Aboriginal people.

Overall Age-Standardized Cancer Mortality by Ethnicity

NWT 2000-2009

Figure 19 (n=450)



Cancer Staging

In 2006, provinces and territories began recording the stage of new cancers at diagnosis when submitting data to the Canadian Cancer Registry. Each type of cancer is staged based on different criteria. Stage 0 and Stage 1 cancers are considered early-stage and more easily cured, Stage 2 and Stage 3 cancers have invaded nearby tissues and are more difficult to treat, and Stage 4 cancers have spread to other parts of the body from the original site and are considered advanced, requiring more complex treatment regimes.[4] By tracking staging information, the effectiveness of NWT screening programs can be measured.

The amount of data available for analysis was limited and few other jurisdictions have incorporated staging into their reports. Staging data were available for most cancer types, but only those representing 5% of all cancers or more are represented in this report. Despite this, some trends were already evident. A total of 391 tumours were available for staging in the interval 2006-2010 (Figure 20).

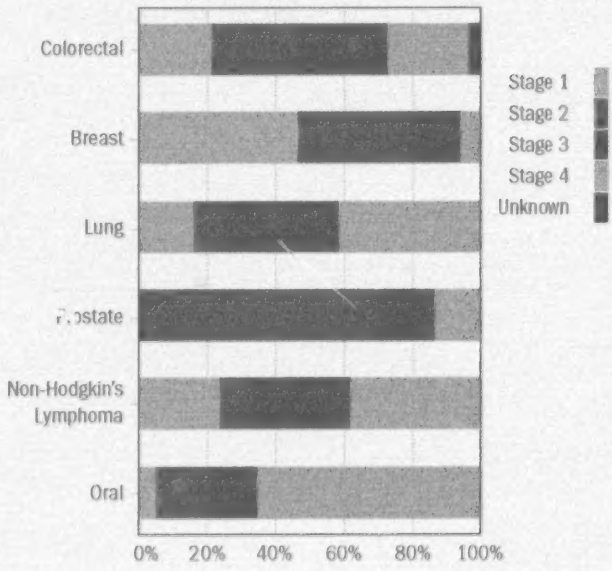
Of the 124 cases of colorectal cancer with staging information almost 50% were diagnosed in either Stage 3 or Stage 4. To compare to a jurisdiction with a longer history of staging tumours, 46.4% of colorectal cancers reported in Manitoba in 2009 were diagnosed in Stage 3 or 4.[5] The 5-year survival rates for colorectal cancers varied from a 74% five-year survival rate for those diagnosed at Stage 1 to as low as 6% for those diagnosed in Stage 4.[6]

Mammography is an effective tool for the early detection of breast cancer and is recommended as a screening test every two years for all females aged 50 to 69 years. In the NWT, 78% of breast cancers are detected in Stage 1 or 2. These figures are comparable to Manitoba, where 80% of breast cancers diagnosed in 2009 were in Stage 1 or 2. Stage 1 breast cancer has a five-year survival rate of 88%.[7]

There is no simple or routine screening test currently recommended for lung cancer. In many cases, there are no noticeable symptoms until the cancer has progressed to a considerable size or has spread to surrounding tissues. Symptoms of lung cancer often correspond to the later stages of the disease. When diagnosed in Stage 4, the five-year survival rate is about 1%.[8] In the NWT, there were 70 cases of lung cancer staged between 2006 and 2010. Of these, 41% were diagnosed at Stage 4. This corresponds with values reported from Manitoba, where 44% of lung cancers from 2009 were diagnosed in Stage 4.[5]

Stage at Diagnosis for Most Frequent Cancer Types

NWT 2006-2010 **Figure 20** (n=391)



A 5-year survival rate is a statistical term that refers to the percentage of people diagnosed with a certain type and stage of cancer who live for at least five years after their date of diagnosis.

Staging data were also available for 64 cases of prostate cancer diagnosed in the NWT between 2006 and 2010. Of these cases, the majority were diagnosed in Stage 2 (61%). Compared to Manitoba, where 74% of prostate cancers were diagnosed in Stage 2, NWT could improve upon the detection of prostate cancer. Stage 2 is the earliest stage at which a physician can detect a tumour during a digital rectal exam. The 5-year survival rate is nearly 100% when prostate cancer is detected at this early stage.[9]

Non-Hodgkin's lymphoma had staging data available for 21 cancers. Of these, 33% were diagnosed in Stage 1 or Stage 2, 29% were diagnosed in Stage 3, and 38% were diagnosed in Stage 4. Survival rates for non-Hodgkin's lymphoma depend on a variety of factors; however, diagnosis in Stage 1 or 2 is considered a good prognostic factor.[10]

Oral cancer had staging data available for 20 cancers. Of these, 65% were diagnosed in Stage 4, the most advanced stage. While the 5-year survival rate for oral cancers depends on the site where the cancer is diagnosed, it is less than 50% at any site when diagnosed at Stage 4.[11]

Cancer Control and Prevention

Cancer risk refers to a person's chance of developing cancer. Very few cancers have a single, known cause. Most cancers result from a complex interaction of many risk factors. It also usually takes many years for cancer to develop after exposure to a risk factor. In general, longer, more intense and more frequent exposure to risk factors increases the chance that cancer will develop. A risk factor is any substance or condition that increases the risk of developing cancer.

Prevention strategies work by helping people reduce their risk of developing cancer. *Primary prevention* is achieved through interventions that prevent the development of the disease in the first place such as health counselling and education, environmental controls and product safety. *Secondary prevention* focuses on interventions leading to early detection and effective control through treatment. Primary and secondary prevention initiatives are required to achieve optimum lifetime strategies.

Different risk factors play different roles in initiating and encouraging cancer growth. Risk factors include non-modifiable factors (e.g. genetic predispositions, hormones, immune conditions, age, etc.) and modifiable factors (e.g. behavioural and lifestyle choices, infectious agents, occupational exposures and exposure to other cancer-causing substances in the environment). Research suggests that only 5-10% of cancers are hereditary, which suggests the other 90-95% of cancers are related to modifiable factors.[12]

Lifestyle Factors

Smoking

Lung cancer is the number one cause of cancer-related death for both males and females in Canada.[13] By far the most important risk factor for lung cancer is tobacco use, including smoking cigarettes and chewing tobacco. Tobacco use is also associated with cancer of the mouth, pharynx, larynx, esophagus, stomach, colon, rectum, liver, pancreas, kidney, urinary bladder, ovary, and cervix, as well as some forms of leukemia.[14,15] There is also evidence that second hand smoke exposure is associated with cancer of the lung, pharynx and larynx.[14,15]

Most cancer sites show a positive dose-response relationship with smoking, with increasing cancer risk associated with both smoking intensity (number of cigarettes per day) and duration of smoking (number of years).[16] For lung cancer, smoking duration is a stronger determinant of risk than smoking intensity.[15]

At more than twice the national rate, smoking in the NWT is a significant public health issue. An estimated 34% of NWT residents 15 years of age and older smoked in 2012,17 compared to 17% in Canada as a whole.[18]

Preliminary analyses of a survey in 2012 for addictions in the NWT reveal the following details about tobacco use among NWT residents:[17]

- 53% of individuals in Small Communities report being current smokers, compared to 29% in Regional Centres and 23% in Yellowknife.
- 51% of Aboriginal people in the NWT are smokers compared to 18% of Non-Aboriginal people.
- Daily smokers report smoking 11 cigarettes a day on average.
- The average age for onset of daily smoking is 17.6 years of age.
- An estimated 14% of residents indicate exposure to second-hand smoke on most days, compared to 5.5% in the rest of Canada.[1]
- 48% of current smokers who saw a doctor in the last year reported that their doctor advised them to quit or reduce smoking, compared to 36% of current smokers who saw a nurse.

In recognition of the significant impact of tobacco use on the health of NWT residents, the GNWT launched *Action on Tobacco*, a territorial strategy for tobacco control, in 2002. The strategy focused on key actions in the areas of prevention, protection, cessation, and denormalization. Since that time, significant progress has been made. Legislation has been an important element of this progress. Smoking was banned in some indoor workplaces in 2004 under the Workers Safety and Compensation Commission's *Mine Health and Safety Act*. The *Tobacco Control Act* came into effect in 2007 providing further protection from second hand smoke, limiting sales locations and advertising, and banning the display of tobacco products at retail.

Nutrition

Researchers believe that the foods people eat over their lifetime can increase or decrease the risk of developing some types of cancers. An estimated one-third of all cancers may be related to what we eat and drink, our body weight and the amount of physical activity we do.

The extent to which diet contributes to cancer deaths varies by cancer type.19 Approximately 30-35% of all cancer deaths are linked to diet.[20] In 2009, 26% of NWT residents aged 12 years and older consumed five servings or more of fruits and vegetables per day, compared to 46% of the Canadian population.[21]

There is scientific evidence to link some food groups, individual foods and specific food components to cancer risk.

Dietary fat: A diet high in fat increases the likelihood of gaining weight. Being overweight or obese increases the risk of several cancers.

Fibre: Vegetables, fruit, whole grain foods, and legumes are high in fibre. Fibre helps keep the digestive system healthy and bowels regular. Eating foods that contain fibre decreases the risk of colorectal cancer.

Fruits & vegetables: Fruits and vegetables are a rich source of vitamins, minerals, dietary fibre, and other micronutrients. Some fruits and vegetables have more important protective effects for certain cancers. For example, foods containing lycopenes (e.g. tomatoes) are likely to protect against prostate cancer; those with carotenoids (e.g. carrots) likely protect against cancer of the mouth, pharynx, larynx and lung; and those with vitamin C (e.g. citrus fruits) protect against esophageal cancer.[14]

Meat intake: Diets high in red meat or processed meat, particularly meat that has been smoked, cured, salted, or otherwise altered by the addition of chemical preservatives, increase the risk of colorectal cancer.[22] Studies have linked cured or smoked meat and eating large amounts of foods preserved by salting and pickling to an increased risk of stomach cancer. Red meat consumption is also a risk factor for prostate, bladder, breast, stomach, pancreatic, and oral cancers.[12] There is approximately an 18% increase in risk for colorectal cancer with every 100g/day increase in red meat or 50g/day increase in processed meat consumption.[23]

Salt: Salt, or sodium chloride, is a flavour enhancer and preservative for many foods. An increase in salt consumption by one gram per day increases the risk for stomach cancer by 8%.[22] Some studies suggest a more than five-fold increase in stomach cancer risk with each additional serving of salty/salted food per day.[22] Stomach cancer risk is also increased by the interaction of salty foods with *H. pylori* infection.[24]

Food handling and preparation: Some methods of cooking, preparing and storing food have been associated with cancer. Some cancer-causing chemicals are created when meats are cooked at high temperatures, increasing the risk of certain cancers such as colorectal cancer.[25] Some harmful substances can also be found in mouldy foods.

Body Composition & Obesity

Obesity is a significant risk factor linked to chronic diseases and cancer. Significant associations with obesity are known for diabetes, cardiovascular diseases, asthma, gallbladder disease, osteoarthritis and chronic back pain. There is convincing evidence for links between body fat, abdominal circumference and adult weight gain with esophageal, colorectal, pancreatic, breast, endometrial, kidney and gallbladder cancer.[22]

Body mass index (BMI) is a measure of body fat that takes into account weight adjusted for height. Obesity is defined by the World Health Organization as a BMI of 30 and above.[26] According to the World Health Organization, obesity has reached epidemic levels.[26] Compared to individuals of normal weight, there is a 30% increased overall risk for cancers among obese males and females.[19, 27] Excess body mass accounts for 7.7% of all cancers in Canada.[27]

The Canadian Community Health Survey reveals that in 2009, 63% of the NWT population age 18 years and older (excluding pregnant females) were overweight or obese. This compares to 37% of the Canadian population who are overweight or obese.[21] These statistics have clear implications for the NWT population with regards to cancer risk.

Physical Activity

Physical activity is necessary to achieve and maintain a healthy body. Extensive research shows that regular physical exercise is associated with a reduction in the risk of colon cancer and a probable decrease in breast and endometrial cancer.[12, 22] A lack of physical activity may be one of the most important lifestyle risk factors for cancer, as regular physical activity is linked to decreased mortality rates and also has a strong association to improved quality of life.[28-31] Physical inactivity accounts for 10% of the burden of disease for breast and colon cancer deaths.[32]

In 2009, 41% of NWT residents aged 12 years and older were considered moderately active or active. This proportion is lower than the national average of 53%.[21] The lack of physical activity presents a public health challenge for the NWT.

Alcohol Consumption

Alcohol consumption is an identified risk factor for cancer of the liver, mouth, oro-pharynx, esophagus, colon, rectum, breast and pancreas.[12] Alcohol consumption also interacts with tobacco smoking in influencing the risk of oral cavity, pharynx, larynx and esophageal cancers.[33] An estimated 10% of cancer cases in males and 3% of cancers in females are attributable to alcohol consumption.[34] Approximately 3.5% of cancer deaths are attributable to alcohol consumption.[35] No clear 'safe limit' of alcohol intake to prevent increased risk of cancer has been determined, despite a protective effect of light alcohol consumption for other chronic diseases such as cardiovascular disease.[22]

In 2009, 47% of current drinkers in the NWT were considered to be heavy drinkers, defined as individuals who consume five or more drinks for males or four or more drinks for females on a single occasion at least once per month.[36] Thirty-five percent (35%) of Yellowknife residents, 47% of Regional Centre residents, and over 50% of residents in Small Communities were heavy drinkers. In comparison, the Canadian average for heavy drinking was 17%.[37] High rates of alcohol consumption present a public health concern in the NWT for cancer and other chronic conditions.

Infectious Agents

Viruses and other biologic infectious agents are associated with certain types of cancer. An estimated 18% of cancers are associated with infections, although fewer than 10% of cancers in developed countries like Canada are attributable to infections.[12] In Canada, Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and Human Papilloma Virus (HPV) are the most common viruses that cause cancer. Two immunization programs in the NWT target cancer-causing viruses.

Hepatitis B Virus (HBV) Vaccine

HBV infects the liver. HBV is found in blood and bodily fluids and can be transmitted by sharing contaminated needles (e.g. intravenous drug use, tattooing, etc.), sexual contact with an infected person, or sharing personal care items (e.g. razors, nail clippers). Most healthy adults (90%) will clear an acute HBV infection within 6 months of being infected; however, those who are unable to clear it will become chronic carriers of the virus.[38] In chronic hepatitis B carriers, the infection causes progressive liver damage and liver cancer.[39] Chronic hepatitis B accounts for 50-70% of liver cancers.[40] The likelihood of surviving five years after a diagnosis of hepatocellular carcinoma, the most common liver cancer sub-type, is 20%.[40]

The NWT's immunization program against HBV is aimed to both prevent the disease and related liver cancers. The vaccine is given to all infants at birth and at one and six months of age.[41]

Human Papillomavirus (HPV) Vaccine

Infection of the cervix with HPV is the greatest risk factor for developing cervical cancer. Of approximately 130 HPV viruses that can be passed from person-to-person through sexual contact, the International Agency for Research on Cancer identifies 25 high-risk HPV viruses capable of causing cancer.[16] In addition to causing cervical cancer, HPVs can cause genital warts as well as cancer of the vagina, vulva, penis, anus, mouth and throat.

It is estimated that 75% of Canadians will have an infection with HPV at some time in their lives.[42] The Society of Obstetricians and Gynaecologists of Canada estimates that 13-26% of the adult population is infected with HPV with the highest rates among those aged between 20-24 years.[43] HPV prevalence in the NWT is approximately 28% among Aboriginal females and 19% among Non-Aboriginal females,[44] with the highest prevalence among females less than 20 years of age. Predictors of infection with high risk types of HPV among females in the NWT include younger age (less than 20 years), single marital status, Aboriginal background, current smoker, not having delivered a child, use of hormonal contraceptives and five or more sexual partners in the last year.[42]

Immunization against HPV before initiation of sexual contact prevents infection 70% of the time.[45] Since 2009, HPV vaccination has been provided in the NWT as a publicly-funded school-based vaccination program for girls in grades 4-6. More than 1250 young females have received the complete three-dose series as of December 2012. At the time of this report, the vaccine was also available to males, but not as part of the publicly-funded vaccine program. The NWT, with other jurisdictions, is examining the costs and benefits of vaccinating both males and females.

Helicobacter pylori Bacteria

Helicobacter pylori (H. pylori) is a bacteria and major cause of peptic ulcer disease and gastritis. Infection typically occurs during childhood and may persist lifelong unless treated. Humans are the only known reservoir of *H. pylori*, and transmission is believed to occur primarily from person-to-person.. According to the US Centers for Disease Control and Prevention, approximately 30-40% of the population in industrialized countries harbours the bacterium, with infection rates approaching 70% in developing countries.[46] Chronic *H. pylori* infection is a major cause of stomach cancer and is associated with an increased risk of gastric mucosa-associated lymphoid tissue (MALT) lymphoma.[46] Evidence suggests that salt and salted foods may interact synergistically with *H. pylori* infection to increase the risk.[47]

Some residents of the NWT may have a high rate of *H. pylori* infection. The Canadian North *H. pylori* (CANHelp) working group, a team of investigators, health officials and community leaders from Alberta and the NWT, have conducted extensive research into *H. pylori* in selected northern communities.[48] The Aklavik *H. pylori* Project (2008) identified positive Urea Breath Tests among 58% of the over 300 recruited participants,[49] compared to the national rate of approximately 30%.[50] This breath test is an effective means of identifying individuals infected by *H. pylori*. The CANHelp Working Group remains active in characterizing the burden of disease from *H. pylori* infection and in exchanging knowledge with community members and decision makers to identify ways to reduce health risks from this infection.[51]

Environmental Risk Factors

Ultraviolet Radiation

Overexposure to ultraviolet (UV) radiation is the leading cause of skin cancer and accounts for 1.5% of cancer deaths worldwide.[52] Sunlight is a major source of UV radiation and sun safety is a priority in primary prevention efforts. Tanning lamps are also a source of UV

and have been linked with increased risk of skin cancer including melanoma.[53] While UV exposure may only cause sunburn in the short term, over time it can cause premature aging of the skin, cataracts, other forms of eye damage, and skin cancer. Skin cancer is the most commonly diagnosed cancer in Canada. It is also one of the most preventable: an estimated 90% of all skin cancers could be prevented.[53] Using sunscreens, avoiding prolonged exposure to the sun, wearing protective clothing, and avoiding tanning beds can reduce the risk. In 2000-2009, 16 cases of malignant melanoma were diagnosed in the NWT.

Ionizing Radiation

Cancer risk increases with exposure to radiation other than UV radiation. Sources include radon and thoron (the radioactive gas released from uranium and thorium decay), x-rays from medical applications, and gamma radiation from terrestrial, cosmic, or atmospheric sources. The four major sources of natural radiation are cosmic radiation, terrestrial radiation, and inhalation and ingestion of naturally-occurring radionuclides.[54]

- Cosmic radiation comes from the sun and outer space. Most cosmic radiation is absorbed by the atmosphere with a small amount reaching the earth's surface. The exposure to this type of radiation is higher for people living at higher altitudes.
- Terrestrial radiation comes from natural sources of radiation in the ground such as from uranium content in the soil. In Canada, the highest estimated annual dose is approximately 2.3 millisieverts (mSv), as measured in the NWT.[54]
- The greatest variation in exposure to natural radiation results from inhalation of radioactive gases, radon and thoron. Radon and thoron are produced through the decay of uranium and thorium respectively, compounds found naturally in the earth's crust. Radon and thoron levels vary considerably by location depending on the composition of soil and bedrock. Radon gas poses a health risk not only to uranium miners, but also to homeowners if it is left to collect in the home. Radon is the largest source of natural radiation exposure for most individuals.[54]
- Trace amounts of radioactive minerals are naturally found in the contents of food and drinking water. Some of the essential elements that make up our bodies have radioactive isotopes. After radon, potassium-40 is the main source of internal irradiation.[54]

Debris from the Russian Cosmos 954, a nuclear-powered reconnaissance satellite which crashed in the NWT in 1978, was speculated to be a potential source of radiological material in the environment. Environmental monitoring of air, soil, drinking water, lichens and food supplies by the Atomic Energy Board (now the Canadian Nuclear Safety Commission) and others has been done following the clean-up operation. Environmental monitoring has not detected radiation beyond background levels expected for the area.[55, 56] A 2012 investigation of cancers among residents of Fort Resolution, a community in the vicinity of some of the Cosmos 954 debris, could not establish causal links between radioactive exposure and cancers among local residents.[57]

Environmental Pollution

Linking environmental exposures to cancer can be challenging since cancer results from a complex interaction of risk factors and can take years to develop. The likelihood that someone will develop cancer in response to a particular, single environmental exposure depends on the duration and quality of the exposure, genetic make-up, age and gender.[58]

Environmental carcinogens are responsible for an estimated 3% of all cancer deaths.[59] For instance, indoor smoke from household use of fossil fuels is estimated to cause 1.5% of lung cancer deaths, most of which occur in low income countries.[60] Outdoor air pollution in urban centres with heavy diesel engine exhaust causes a 50% increase in lifetime risk for lung cancer.[61] Occupational studies of workers with elevated exposures to specific compounds have been instrumental in identifying certain carcinogens. For example, mesothelioma, a rare type of lung cancer, was linked to asbestos exposure through the elevated rate among asbestos miners.

The federal Northern Contaminants Program was established in 1991 to address concerns about human exposure to contaminants, such as heavy metals and organochlorines, in traditionally harvested foods. The sources of these contaminants may be located in the north, such as those from the Cold War era Distant Early Warning (DEW) line sites, or more commonly come north from southern industrial and agricultural sources, carried by long-distance wind currents. Contaminants can accumulate in fish and wildlife along the food chain. Public health advisories are issued for certain country foods if there are substantiated health risks based on scientific research and toxicological assessment.

Contaminants may sometimes be present in fish and wildlife at levels of concern, but the benefits of physical activity while harvesting, preparing and consuming traditional/country foods are believed to outweigh the health risks in most instances. Traditional/country food has significant nutritional value which can help maintain health better than many popular market foods, some of which are associated with diabetes, obesity, heart disease and others. In the north, where healthy market foods can be expensive and unaffordable to those on limited budgets, the traditional diet offers nutritional, social, cultural, spiritual, and economic benefits.

The relative contribution of environmental contamination to cancer incidence or prevalence is not well understood at this time, particularly when compared to other well understood and prevalent risk factors in the NWT. The GNWT will continue to participate in the Northern Contaminants Program so that new research and information can inform our understanding of environmental contaminants in relation to human health.

Early Detection and Cancer Screening

Regular screening of at-risk but seemingly healthy individuals within the population is one of several strategies for improving early detection. A screening test needs to be very sensitive and accurate, with as few false-positive and false-negative results as possible. The test must be also acceptable to the population at risk: the cost-effectiveness of a screening program is compromised unless there is a high participation rate from the target population. Screening tests are directed at certain age groups or individuals with behavioural or genetic risk factors (e.g. history of cancer in family) in order to improve the chances of detection and to minimize potential harm stemming from false-positive test results (e.g. unnecessary anxiety or risks from further invasive investigations). A population-based cancer-screening program should benefit both the individual, and the target population.

In the NWT there are three routine screening programs in place:

(1) Mammography for breast cancer,
(2) Pap tests for cervical cancer and
(3) Fecal Immunochemical Tests (FIT) for colorectal cancer screening.

There is no screening program for prostate cancer due to insufficient evidence of effectiveness for widespread screening at this time.[62] Although lung cancer is a leading cause of cancer death in the NWT, there are currently no screening tests for lung cancer that meet the levels of specificity, sensitivity, acceptability and cost effectiveness required to be implemented as an organized screening program.

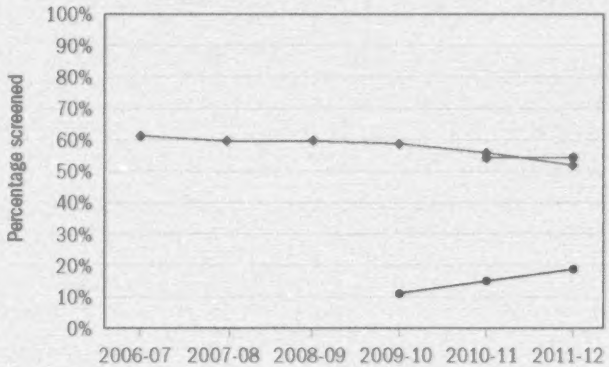
Cancer screening data is presented for all the years available. While cancer screening tests were available to the NWT population before the period presented below, the systematic collection of territory-wide data only began in 2006 for cervical cancer screening, 2009 for colorectal cancer screening, and 2010 for breast cancer screening. Cancer screening recommendations suggest one test every two years; therefore data is presented by two-year intervals, in which individuals have at least one screening test within the two-year interval. The denominator population for each screening test is the total target population for the screening test, which varies by type of cancer.

Varying participation rates were observed for NWT's three screening programs (Figure 21). While over 50% of the eligible population for cervical and breast cancer had at least one screening test in 2011-2012, only 20% of the eligible population were screened for colorectal cancer in the same interval.

Percentage of Eligible Adults With At Least One Cancer Screening Test, by Type of Test

NWT 2006-2012

Figure 21



	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Cervical	62%	60%	60%	59%	57%	53%
Breast					55%	55%
Colorectal				13%	17%	20%

Colorectal Cancer Screening

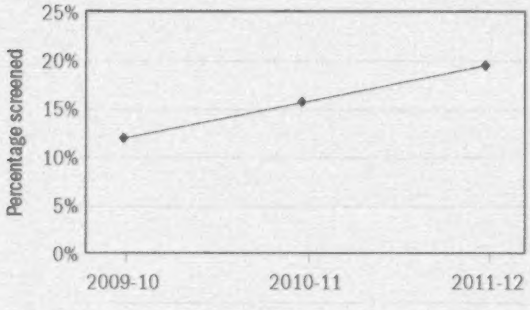
The FIT test detects microscopic blood components in stool, an early indicator of potential colorectal cancer. Individuals who test positive are referred for colonoscopy, potentially including biopsy, to further investigate whether cancer is truly present. Studies indicate that screening among 50-74 year olds can decrease cancer incidence by 18% and mortality by 30%.[63,64] For comparison, in 2008, 32% of those eligible aged 50-74 years in Canada reported having submitted a screening FIT in the previous two years.[1] In 2003, the percentage was 13%. Approximately 20% of eligible individuals aged of 50 to 74 in the NWT had one FIT in 2011 and 2012 (Figure 22).

Participation rates for colorectal cancer screening varied by community type (Figure 23). While the largest percentage of individuals who had the test done was found in Yellowknife, there was a statistically significant increase in the percentage of adults in Small Communities who participated in screening over the three years observed. Significant differences in screening rates for colorectal cancer were also identified between different ethnicities (Figure 24). The percentage of the population of interest screened ranged between 4% and 25% inclusive. Dene, Métis and Non-Aboriginal test rates had a statistically significant increasing trend ($p<0.0001$). The decrease in the Inuit test rates in 2010-2011 was likely due to the fact that a colorectal cancer screening pilot project was active in the Beaufort-Delta region in 2009. Test rates for Inuit were not sustained following this pilot project but more recent rates are showing an increasing trend.

The coverage rate of FIT screening significantly increased in all age groups from 2009-2010 to 2011-2012, from 10%-15% up to 19%-22% of eligible individuals (Figure 25). The greatest increase was in the 70-74 age group, moving from the group with the lowest percentage of testing in 2009-2010 to the group with the highest percentage of testing in 2011-2012. Increased screening participation for all targeted age groups should be promoted.

Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period

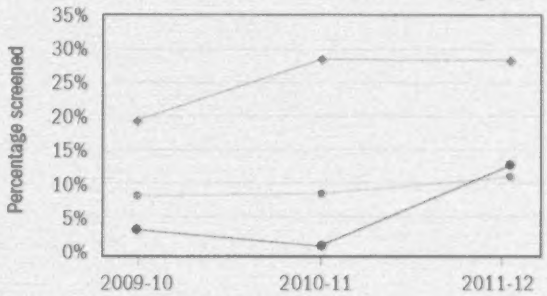
NWT 2009-2012 Figure 22



	2009-10	2010-11	2011-12
Percent	13%	17%	20%

Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period, by Community Type

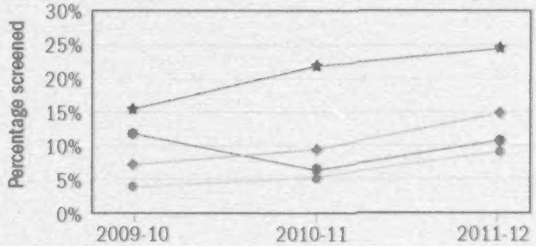
NWT 2009-2012 Figure 23



	2009-10	2010-11	2011-12
Yellowknife	21%	30%	29%
Regional Centres	4%	2%	14%
Small Communities	9%	9%	12%

Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period, by Ethnicity

NWT 2009-20012 Figure 24

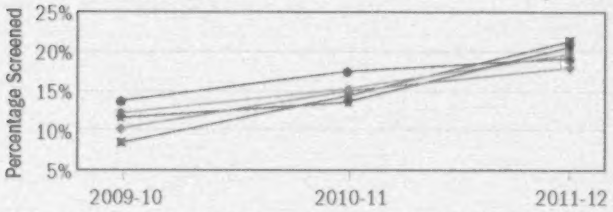


	2009-10	2010-11	2011-12
Dene	8%	10%	16%
Inuit	12%	7%	11%
Métis	5%	6%	10%
Non-Aboriginal	16%	23%	25%

Percentage of Eligible Adults With At Least One FIT Result in a Two-Year Period, by Age Group

NWT 2009-2012

Figure 25



	2009-10	2010-11	2011-12
50-54	11%	16%	19%
55-59	15%	18%	20%
60-64	13%	16%	21%
65-69	13%	15%	22%
70-74	10%	15%	22%

Cervical Cancer Screening

The Canadian Cancer Society estimated 1450 new cervical cancer cases would be diagnosed in 2013, with approximately 380 deaths due to cervical cancer.[60] Over the past 50 years, cervical cancer incidence and mortality have decreased substantially and post-treatment long-term survival rates are high.[65,66] Lifetime incidence continues to decline from 1.5% in 1972 to 0.7% at present. The risk of death from cervical cancer is very low (0.2%). The benefits of cervical cancer screening on reducing new cases and deaths from cervical cancer have been consistently shown in studies. The improvements in rates are the result of screening programs.[67]

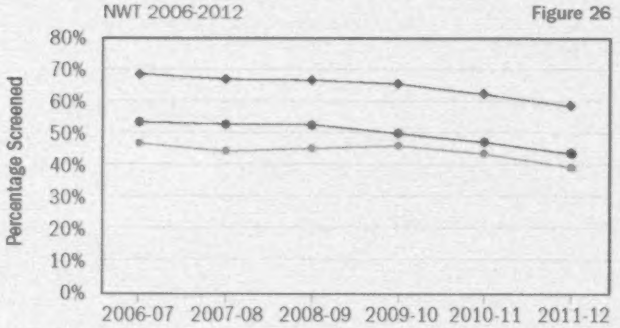
The Papanicolaou test (Pap test) is the screening test for cervical cancer used in the NWT. The test detects cancerous and precancerous cells on the cervix. Females with abnormal cells on a Pap test are referred for colposcopy and/or biopsy of the cervix and some are further tested for presence of Human Papilloma Virus. Decisions regarding further treatment are based on these more definitive tests and not on Pap results alone.

The percentage of the NWT population eligible for Pap screening who were compliant with screening recommendations was approximately 53% in 2011 and 2012. There was a statistically significant decline in the screening rates in all three community types, though the decline was steeper in Yellowknife and the Regional Centres than in Smaller Communities. Smaller Communities had the lowest coverage rates in 2011-2012, at 42%, compared to 47% in regional centres and 61% in Yellowknife (Figure 26).

Percentage of Eligible Females With At Least One Pap Test in a Two-Year Period, by Community Type

NWT 2006-2012

Figure 26



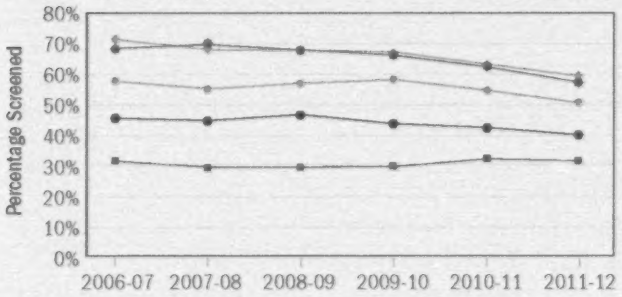
	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Yellowknife	71%	70%	69%	69%	65%	61%
Regional Centres	56%	56%	56%	52%	50%	47%
Small Communities	50%	47%	48%	49%	46%	42%

There was a downward trend in the percentage of females screened in all ethnic groups. The rate of screening in Dene, Inuit and Non-Aboriginal populations was roughly equivalent throughout the entire period for which there are data. Métis females, with a rate as low as 32.9%, had a significantly lower screening rates than the other populations (Figure 27).

The percentage of females with regular Pap tests also decreased with age, with age groups 21-29 years and 30-39 years showing the highest screening rates. The screening rate had declined since 2006-2007 in every age group except for the 60-69 age group, where it remained stable (Figure 28). The downward trend in screening rates is of concern from a population health perspective given that screening is the best way to detect cancers early.

Percentage of Eligible Females With At Least One Pap Test in a Two-Year Period, by Age Group

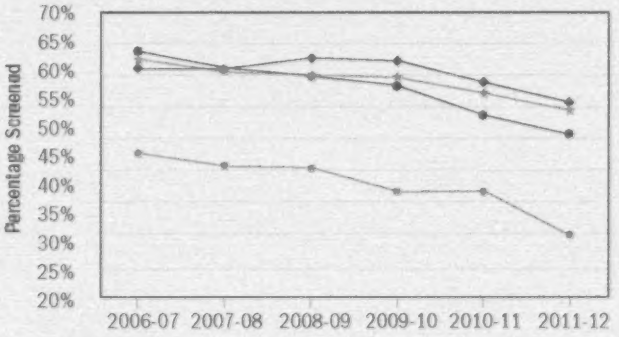
NWT 2006-2012 **Figure 28**



	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
21-29	73%	70%	70%	69%	65%	61%
30-39	70%	71%	70%	68%	64%	59%
40-49	59%	57%	58%	60%	57%	52%
50-59	47%	46%	48%	45%	44%	42%
60-69	33%	31%	32%	32%	33%	33%

Percentage of Eligible Females With At Least One Pap Test in a Two-Year Period, by Ethnicity

NWT 2006-2012 **Figure 27**



	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Dene	61%	61%	63%	62%	59%	56%
Inuit	63%	62%	60%	58%	53%	50%
Métis	47%	45%	44%	40%	40%	33%
Non-Aboriginal	63%	61%	60%	60%	57%	54%

Breast Cancer Screening

An estimated 5,100 Canadians died of breast cancer in 2013.[49] Reducing breast cancer mortality hinges on breast awareness and mammography. The Canadian Breast Cancer Foundation encourages females and males to practice breast awareness *'to know how your breasts normally look and feel, so that you notice any unusual changes earlier and discuss your concerns with a health care provider.'*[68] Being 'breast aware' is as important as mammography for early cancer detection.

Mammography screening uses low-energy X-rays to screen for potentially cancerous masses in the breast. Females with an abnormal mammogram will be recalled for a diagnostic mammogram; based on these findings, they may be referred for a biopsy, with diagnosis and treatment based on biopsy results.

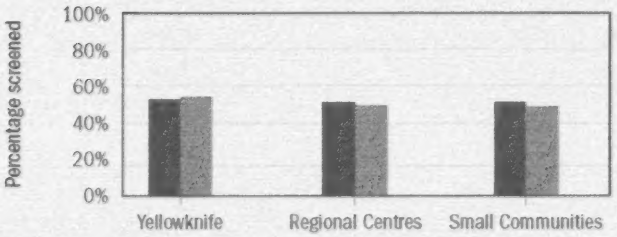
Studies indicate that screening among females aged 50-69 can decrease cancer mortality by 25-30%.[69] Females less than 50 years of age are screened on the recommendation of their physician or through self-referral based on individual level risk factors and perceived benefits. Breast cancer screening guidelines were changed in 2013 to include females aged 70-74 in regular screening. Analysis in this report considers screening rates based on the former guidelines, which only included females aged 50-69.

Over the past 20 years, survival rates from breast cancer have been steadily improving. More breast cancers are being detected earlier, which translates to a relative increase in the rate of breast cancer. However, mortality from breast cancer is decreasing as survivors live longer, benefiting from early detection and treatment.

In 2010 and 2011, the percentage of eligible females aged 50-69 years who had a mammogram within a two-year period was 54% to 56% in all community types. The 2011 and 2012 time period saw a slight increase in Yellowknife, to 58%, and a decrease in Regional Centres and Small Communities, to 53% and 52%, respectively (Figure 29).

Percentage of Eligible Females With At Least One Mammogram in a Two-Year Period, by Community Type

NWT 2010-2012 Figure 29



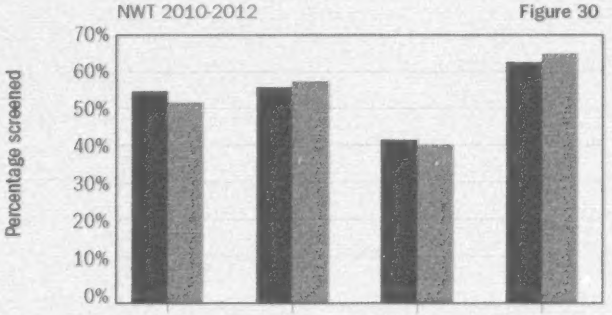
	Yellowknife	Regional Centres	Small Communities
2010-11	56%	55%	54%
2011-12	58%	53%	52%

Non-Aboriginal females had the highest breast cancer screening rates, with 63% screened in 2010-2011 and 65% screened in 2011-2012, followed by Inuit females, with 56% and 58% over the two years, and Dene females, with 56% and 52% over the two years (Figure 30). The coverage rate for Métis females was considerably lower, with 43% coverage in 2010-2011 and 41% coverage in 2011-2012.

Females aged 60-64 had the highest screening rates: 63% had mammography in each of the 24-month periods (Figure 31). Females aged 65-69 and 50-54 had similar rates, ranging from 58% to 60% in both time periods. Females aged 55-59 had the lowest screening rate, with 56% of females screened in each time period. As screening is the best opportunity to identify cancers early, increasing the proportion of females receiving mammograms is an important goal to improve public health.

Percentage of Eligible Females With At Least One Mammogram in a Two-Year Period, by Ethnicity

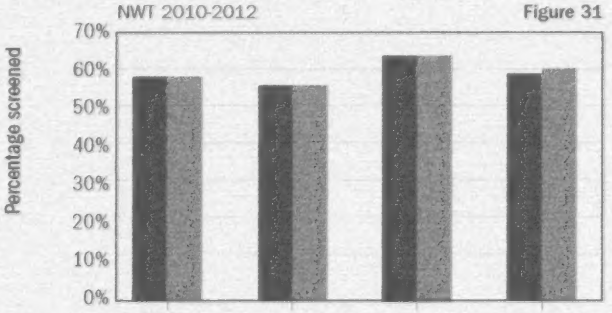
NWT 2010-2012 Figure 30



	Dene	Inuit	Métis	Non-Aboriginal
2010-11	56%	56%	43%	63%
2011-12	52%	58%	41%	65%

Percentage of Eligible Females With At Least One Mammogram in a Two-Year Period, by Age Group

NWT 2010-2012 Figure 31



	50-54	55-59	60-64	65-69
2010-11	58%	56%	63%	58%
2011-12	58%	56%	63%	60%

Developing A Cancer Strategy for the NWT

Faced with an aging population, the NWT can expect an increasing cancer burden that weighs heavily on the NWT health system's capacity to respond to the disease, as well as on the quality of life experienced by NWT residents living with and affected by cancer. Indeed, a single cancer death can reverberate with particular devastation in small communities, where residents are intimately connected by familial and friendship ties.

Formal, coordinated measures are necessary to lessen this burden while reducing inequities with respect to cancer incidence and cancer care. The GNWT has developed a number of strategies in recent years that contribute to this end, such as the *Territorial Strategy for Tobacco Control;* the *Healthy Choices Framework;* the *Mental Health and Addictions Action Plan;* the *Chronic Disease Management Strategy;* and the *Strategic Framework Toward the Elimination of Poverty*. Together, such documents provide an institutional backdrop and context for the first *NWT Cancer Strategy*.

Cancer strategy activities are well underway. In 2012, the GNWT partnered with the Saint Elizabeth First Nations, Inuit and Métis Program to deliver cancer sharing circles in Fort Good Hope and Fort Resolution. A third sharing circle took place in Fort Liard in the summer of 2013. These sharing circles fostered culturally-appropriate, meaningful discussions and learning about cancer, placing value on the knowledge already held by participants (cancer survivors, community members, health care professionals, and facilitators). The sharing circles revealed several areas to improve cancer prevention efforts and cancer care, notably: risk factor and screening education and awareness; availability of culturally-appropriate resources; integration of traditional medicine; palliative care and survivor support groups; and medical travel and transportation. Similar sessions will take place in other NWT regions.

In addition to data collection and partnership-building within NWT communities, the GNWT Department of Health and Social Services established important structures to support the development and implementation of the *NWT Cancer Strategy*. In June 2013, the Aboriginal Health and Community Wellness Division was created. This division is mandated to spearhead the development of the *NWT Cancer Strategy*, and develop culturally respectful and meaningful prevention and promotion programs that will be effective in Aboriginal communities. The Department assembled an expert advisory committee comprised of cancer survivors and caregivers, Health and Social Services Authority senior managers and health care providers, community leaders, Aboriginal governments, and Department staff. This group, known as the Cancer Strategy Advisory Committee, will provide strategic guidance and input throughout strategy development, ensuring alignment with stakeholder needs and priorities.

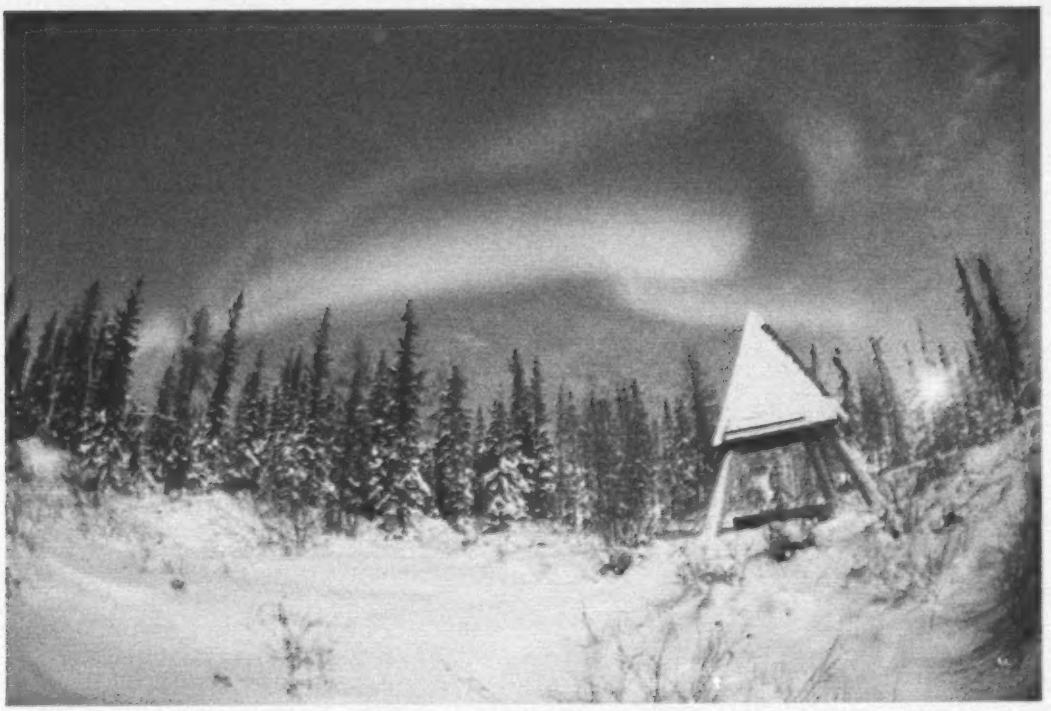
To date, information gathered from cancer sharing circles, the Cancer Strategy Advisory Committee, epidemiological studies such as this cancer report, and other sources point to three primary areas of emphasis for the *NWT Cancer Strategy*:

1. **Raising awareness to prevent and detect cancer:** At the core of the strategy will be a cancer communication plan that aims to improve awareness and knowledge among NWT residents and thus bolster cancer prevention efforts, notably through increased uptake of screening services. Information needs to be delivered in a way that takes into account cultural preferences; for example, the dissemination of oral-based resources.
2. **Improving the continuity of cancer care:** From delivery of diagnosis through survivorship, NWT cancer patients need support in their cancer journey. For cancer patients from the regional centres and smaller communities, this involves travelling between their home communities and Yellowknife, as well as travelling to Alberta for cancer care. Work remains to be done to fill certain gaps that exist along this continuum of services and supports.

3. **Enhancing the quality of life of cancer patients:** Community health representatives, social workers, and caregivers can be empowered to implement patient discharge and survivorship care plans, as well as palliative and end-of-life care, in collaboration with primary care providers. Additional support should be provided to those who play key roles in preserving the comfort and dignity of patients faced with life-threatening illness.

Each of these three areas will be explored and promoted through an equity lens, with close examination of the social determinants of health. Historical trauma stemming from events such as colonialism and residential schooling, combined with geographic, cultural, and linguistic barriers to accessing Western-style health services, diminish Aboriginal residents' ability to make healthy choices. This situation has led to alarmingly high prevalence of cancer risk factors such as alcohol and tobacco use, inadequate diet, and physical inactivity. The *NWT Cancer Strategy* will need to address the disparities between Aboriginal and non-Aboriginal peoples, and nurture an environment of cultural safety and cultural sensitivity in health service delivery.

Actions to reduce cancer will have connections to curbing chronic disease . A comprehensive, evidence-based cancer strategy, with measurable backing from multiple stakeholders and sectors, will help lessen the burden of other illnesses that share the same major risk factors, such as diabetes, cardiovascular disease, and chronic respiratory disease. By adopting an equity lens, the strategy will lead to culturally-appropriate ways to achieve healthy living and community wellness as a whole.



References

1. Statistics Canada. Canadian Community Health Survey (2009/2010). Microdata File. Statistics Canada; .
2. Statistics Canada. Canadian Standard Population-1991. Available at: http://www.statcan.gc.ca/pub/82-003-x/2013008/article/11857/tbl/appa-eng.htm. Accessed December 23, 2013.
3. Statistics Canada. Ten leading causes of death by selected age groups, by sex, Canada. Available at: http://www.statcan.gc.ca/pub/84-215-x/2011001/tbl/t001-eng.htm#T001FN1. Accessed December 23, 2013.
4. American Society of Clinical Oncology (ASCO). Stages of Cancer. Available at: http://www.cancer.net/all-about-cancer/treating-cancer/stages-cancer. Accessed December 23, 2013.
5. Cancer Care Manitoba. Cancer in Manitoba - Annual Statistical Report. 2009.
6. American Cancer Society. Colorectal Cancer. Available at: http://www.cancer.org/cancer/colonandrectumcancer/detailedguide/colorectal-cancer-survival-rates. Accessed December 23, 2013.
7. American Cancer Society. Breast Cancer. Available at: http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-survival-by-stage. Accessed December 23, 2013.
8. American Cancer Society. Lung Cancer (Non-Small Cell). Available at: http://www.cancer.org/cancer/lungcancer-non-smallcell/detailedguide/non-small-cell-lung-cancer-survival-rates. Accessed December 23, 2013.
9. American Cancer Society. Prostate Cancer. Available at: http://www.cancer.org/cancer/prostatecancer/detailedguide/prostate-cancer-survival-rates. Accessed December 23, 2013.
10. American Cancer Society. Non-Hodgkin's Lymphoma. Available at: http://www.cancer.org/cancer/non-hodgkinlymphoma/detailedguide/non-hodgkin-lymphoma-factors-prognosis. Accessed December 23, 2013.
11. American Cancer Society. Oral Cavity and Oropharyngeal Cancer. Available at: http://www.cancer.org/cancer/oralcavityandoropharyngealcancer/detailedguide/oral-cavity-and-oropharyngeal-cancer-survival-rates. Accessed December 23, 2013.
12. Anand P, Kunnumakkara AB, Sundaram C, et al. Cancer is a preventable disease that requires major lifestyle changes. *Pharm Res*. 2008;25:2097-2116.
13. Navaneelan T, Janz T. Cancer in Canada: Focus on Lung, Colorectal, Breast and Prostate. Canada: Statistics Canada; 2011. Available from: http://publications.gc.ca/collections/collection_2012/statcan/82-624-x/82-624-x2011001-3-eng.pdf.
14. Cancer Care Ontario. Cancer Risk Factors in Ontario: Evidence Summary. Toronto, Canada: Cancer Care Ontario; 2013. Available from: www.cancercare.on.ca/riskfactor.
15. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Lyon, France: IARC Press; 2004;83. Available from: http://monographs.iarc.fr/ENG/Monographs/vol83/.
16. International Agency for Research on Cancer (IARC). A review of Human Carcinogens. Part B: Biological Agents. Lyon, France: WHO Press; 2012.
17. Government of the Northwest Territories. 2012 NWT Addictions Survey. 2014".
18. Health Canada. Canadian Tobacco Use Monitoring Survey (CTUMS) 2011. Available at: http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/ctums-esutc_2011-eng.php. Accessed December 23, 2013.
19. Willett WC. Diet and cancer. *Oncologist*. 2000;5:393-404.
20. Doll R, Peto R. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. *J Natl Cancer Inst*. 1981;66:1191-1308.
21. Government of the Northwest Territories. Northwest Territories Health Status Report. Northwest Territories: Northwest Territories Health and Social Services; 2011. Available from: www.hlthss.gov.nt.ca.
22. World Cancer Research Fund / American Institute for Cancer Research. Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Prespective. Washington, DC: AICR; 2007.
23. Chan DS, Lau R, Aune D, et al. Red and processed meat and colorectal cancer incidence: meta-analysis of prospective studies. *PLoS One*. 2011;6:e20456.
24. Wang XQ, Terry PD, Yan H. Review of salt consumption and stomach cancer risk: epidemiological and biological evidence. *World J Gastroenterol*. 2009;15:2204-2213.
25. Santarelli RL, Pierre F, Corpet DE. Processed meat and colorectal cancer: a review of epidemiologic and experimental evidence. *Nutr Cancer*. 2008;60:131-144.
26. World Health Organization. Obesity: Preventing and managing the global epidemic: report of a WHO consultation. Geneva, Switzerland: World Health Organization; 2000;894. Available from: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/.
27. Pan SY, Johnson KC, Ugnat AM, Wen SW, Mao Y, Canadian Cancer Registries Epidemiology Research Group. Association of obesity and cancer risk in Canada. *Am J Epidemiol*. 2004;159:259-268.
28. Petrelli NJ, Winer EP, Brahmer J, et al. Clinical Cancer Advances 2009: major research advances in cancer treatment, prevention, and screening--a report from the American Society of Clinical Oncology. *J Clin Oncol*. 2009;27:6052-6069.
29. Bellizzi KM, Rowland JH, Jeffery DD, McNeel T. Health behaviors of cancer survivors: examining opportunities for cancer control intervention. *J Clin Oncol*. 2005;23:8884-8893.
30. Kendall AR, Mahue-Giangreco M, Carpenter CL, Ganz PA, Bernstein L. Influence of exercise activity on quality of life in long-term breast cancer survivors. *Qual Life Res*. 2005;14:361-371.

31. Lee CD, Sui X, Hooker SP, Hebert JR, Blair SN. Combined impact of lifestyle factors on cancer mortality in men. *Ann Epidemiol*. 2011;21:749-754.

32. Lee IM, Shiroma EJ, Lobelo F, et al. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet*. 2012;380:219-229.

33. International Agency for Research on Cancer (IARC). A Review of Human Carcinogens. Part E: Personal Habits and Indoor Combustions. Lyon, France: WHO Press; 2012.

34. Schutze M, Boeing H, Pischon T, et al. Alcohol attributable burden of incidence of cancer in eight European countries based on results from prospective cohort study. *BMJ*. 2011;342:d1584.

35. Boffetta P, Hashibe M, La Vecchia C, Zatonski W, Rehm J. The burden of cancer attributable to alcohol drinking. *Int J Cancer*. 2006;119:884-887.

36. Government of the Northwest Territories. NWT Addictions Report: Prevalence of alcohol, illicit drug, tobacco use and gambling in the Northwest Territories. Northwest Territories: Northwest Territories, Health and Social Services; 2010. Available from: www.hlthss.gov.nt.ca.

37. Statistics Canada. Heavy Drinking by Age Group. Available at: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/health79b-eng.htm. Accessed December 27, 2013.

38. The Public Health Agency of Canada. Hepatitis B - Get the Facts. Available at: http://www.phac-aspc.gc.ca/hcai-iamss/bbp-pts/hepatitis/hep_b-eng.php. Accessed December 27, 2013.

39. Hepatitis B Foundation. Hepatitis B and Primary Liver Cancer. Available at: http://www.hepb.org/professionals/hepb_and_liver_cancer.htm. Accessed December 27, 2013.

40. Canadian Cancer Society's Advisory Committee on Cancer Statistics. Canadian Cancer Statistics 2013. Toronto, Ontario: Canadian Cancer Society; 2013.

41. Government of the Northwest Territories. NWT Immunization Schedule. Available at: http://www.hss.gov.nt.ca/sites/default/files/nwt_immunization_schedule_0.pdf. Accessed December 27, 2013.

42. Brassard P, Jiang Y, Severini A, et al. Factors associated with human papillomavirus infection among women in the Northwest Territories. *Can J Public Health*. 2012;103:e282-7.

43. Money DM, Provencher DM. Epidemiology and Natural History of HPV Infection. *Journal of Obstetrics and Gynaecology Canada*. 2007;29:S7.

44. Jiang Y, Brassard P, Severini A, et al. Type-specific prevalence of Human Papillomavirus infection among women in the Northwest Territories, Canada. *J Infect Public Health*. 2011;4:219-227.

45. Immunize BC. HPV (Human Papillomavirus). Available at: http://immunizebc.ca/diseases-vaccinations/hpv. Accessed December 27, 2013.

46. Centers for Disease Control and Prevention. Helicobacter pylori. Available at: http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-3-infectious-diseases-related-to-travel/helicobacter-pylori. Accessed December 27, 2013.

47. Wang XQ, Terry PD, Yan H. Review of salt consumption and stomach cancer risk: epidemiological and biological evidence. *World J Gastroenterol*. 2009;15:2204-2213.

48. Cheung J, Goodman K, Munday R, et al. Helicobacter pylori infection in Canada's arctic: searching for the solutions. *Can J Gastroenterol*. 2008;22:912-916.

49. CANHelp working group. Why more stomach cancer in Aklavik, NWT. Available at: http://www.canhelpworkinggroup.ca/downloads/SIKU%20News_2008-02-13.pdf. Accessed December 27, 2013.

50. Goodman KJ, Jacobson K, Veldhuyzen van Zanten S. Helicobacter pylori infection in Canadian and related Arctic Aboriginal populations. *Can J Gastroenterol*. 2008;22:289-295.

51. CANHelp working group. CANhelp Working Group. Available at: http://www.canhelpworkinggroup.ca/. Accessed December 27, 2013.

52. Canadian Cancer Society/National Cancer Institute of Canada. Canadian Cancer Statistics-2012. Canada: Canadian Cancer Society; 2012. Available from: Cancer.ca.

53. International Agency for Research on Cancer Working Group on artificial ultraviolet (UV) light and skin cancer. The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: A systematic review. *Int J Cancer*. 2007;120:1116-1122.

54. Canadian Nuclear Safety Commision. Natural Background Radiation Factsheet. Available at: http://www.nuclearsafety.gc.ca/eng/pdfs/Fact_Sheets/Fact-Sheet-Background-Radiation-eng.pdf. Accessed December 27, 2013.

55. Taylor HW, Hutchison EA, McInnes KL, Svoboda J. Cosmos 954: search for airborne radioactivity on lichens in the crash area, northwest territories, Canada. *Science*. 1979;205:1383-1385.

56. Tracy BL, Prantl FA, Quinn JM. Health impact of radioactive debris from the satellite Cosmos 954. *Health Phys*. 1984;47:225-233.

57. Durigon M, Santos M, Mayhew M. Investigation of a Cancer Cluster - Northwest Territories, Canada, Feb-Mar 2012. TEPHINET 7th Global Scientific Conference. Unpublished; 2012.

58. National Cancer Institute. Cancer and the Environment. Available at: http://www.cancer.gov/cancertopics/understandingcancer/environment. Accessed December 27, 2013.

59. Peto J. Cancer epidemiology in the last century and the next decade. *Nature*. 2001;411:390-395.

60. World Health Organization. Indoor Air Pollution and Health. Available at: http://www.who.int/mediacentre/factsheets/fs292/en/. Accessed December 27, 2013.

61. Rushton L. The problem with Diesel. *J Natl Cancer Inst*. 2012;104:796-797.

62. Walsh PC. Re: Screening for prostate cancer: U.S. Preventive Services Task Force recommendation statement. *J Urol*. 2012;188:1181.

63. Imperiale TF, Ransohoff DF, Itzkowitz SH, Turnbull BA, Ross ME, Colorectal Cancer Study Group. Fecal DNA versus fecal occult blood for colorectal-cancer screening in an average-risk population. *N Engl J Med*. 2004;351:2704-2714.

64. Mandel JS, Bond JH, Church TR, et al. Reducing mortality from colorectal cancer by screening for fecal occult blood. Minnesota Colon Cancer Control Study. *N Engl J Med*. 1993;328:1365-1371.

65. Franco EL, Duarte-Franco E, Ferenczy A. Cervical cancer: epidemiology, prevention and the role of human papillomavirus infection. *CMAJ*. 2001;164:1017-1025.

66. Dickinson JA, Stanklewicz A, Popadiuk C, Pogany L, Onysko J, Miller AB. Reduced cervical cancer incidence and mortality in Canada: national data from 1932 to 2006. *BMC Public Health*. 2012;12:992-2458-12-992.

67. Canadian Task Force on Preventive Health Care, Pollock S, Dunfield L, et al. Recommendations on screening for cervical cancer. *CMAJ*. 2013;185:35-45.

68. Canadian Breast Cancer Foundation. Breast Awareness. Available at: http://www.cbcf.org/prairies/AboutBreastHealth/Breast-Awareness/Pages/default.aspx. Accessed December 27, 2013.

69. Schopper D, de Wolf C. How effective are breast cancer screening programmes by mammography? Review of the current evidence. *Eur J Cancer*. 2009;45:1916-1923.

70. Canadian Cancer Society's Advisory Committee on Cancer Statistics. Canadian Cancer Statistics 2011. Toronto, Ontario: Canadian Cancer Society; 2011.

71. Finlayson A. Calculation of Standardized Rates and Ratios: Direct and Indirect Methods. Scotland: NHS Information Services; 2001.

72. Jensen O, Parkin D, MacLennan R, Muir C, Skeet R. Cancer Registration: Principles and Methods. Lyon, France: IARC Scientific Publications; 1991;95. Available from: http://www.iarc.fr/en/publications/pdfs-online/epi/sp95/.

73. Bains N. Standardization of Rates. Available at: http://www.apheo.ca/resources/indicators/Standardization%20report_NamBains_FINALMarch16.pdf. Accessed December 23, 2013.

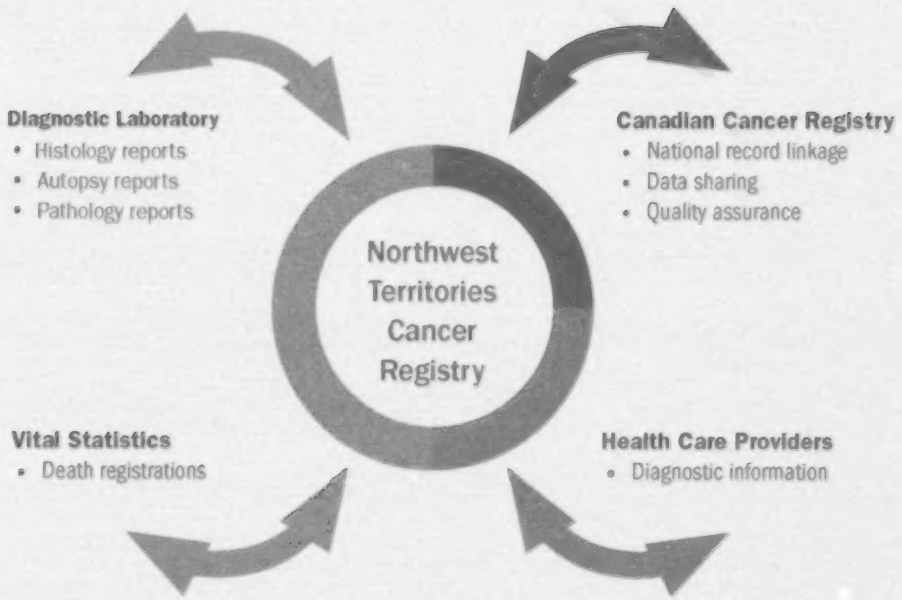
Annex 1: Methodology

Cancer Data Collection

A newly diagnosed tumour can be recorded in the NWT Cancer Registry in several ways (Figure 32). Usually notification is received from a diagnostic laboratory and/or the patient's primary physician. Occasionally the NWT Cancer Registry is notified by the Canadian Cancer Registry or another provincial/territorial registry of a cancer diagnosed and registered elsewhere. Registry staff may also be alerted to an unreported or previously undiagnosed tumour through a periodic review of death certificates. When a cancer is indicated as contributing to the death of an individual on a death certificate, Registry staff contact health care providers to verify the relevant diagnostic information.

Sources of Cancer Registration Data

Figure 32



Comprehensive registration of cancer incidence using multiple sources of information presents significant challenges. The Department's Population Health Division leads on the many activities required to ensure data accuracy, completeness and integrity of the NWT Cancer Registry. The Department contracts the Alberta Cancer Board (under the authority of Alberta Health Services) to administer the Registry. The Alberta Cancer Board created a separate territorial registry within its infrastructure and began to enter and stage all NWT cancer cases diagnosed from 2006 onwards. It also submits all required datasets to Statistics Canada and the North American Association of Central Cancer Registries.

As proprietor of the registry, the Department maintains responsibility for all aspects of the NWT Registry and any decisions regarding the data and its contents. The data administrators at Alberta Health Services must adhere to the laws of confidentiality. Similar contracts for data administration exist between Ontario and Nunavut, and between the Yukon and British Columbia.

Two important measures of data quality are the percent of cancers confirmed microscopically by laboratory, and the percent of cases confirmed only from death certificates. The NWT Cancer Registry contains few records from death certification alone or unknown methods of diagnosis. For the purposes of this report, 92.6% of incident cases were confirmed microscopically.

Since 2008, the NWT Cancer Registry has improved case ascertainment by record linking with records from the Discharge Abstract Database. This database captures information on all hospital admissions and day surgeries performed in hospital. Hospital admissions for cancers were reviewed from 2000 onwards. Cancers treated in Alberta but not necessarily captured in the NWT are reported in a timely manner given the relationship with Alberta Health Services.

The Registry also has consistent access to vital statistics information to improve on the capture of death certificate only cases. As a consequence of these improved methods of active surveillance, the number of cases reported has increased. However, it is unclear the degree to which these improvements contribute to the overall increasing trend in cancer incidence.

Data Sources

NWT data from the Canadian Cancer Registry from 2001 to 2010 was used for the analysis of cancer incidence. Cancer mortality data was derived from the NWT Vital Statistics Registry (2000-2009). Due to the relatively small population and limited annual number of cancer reports, data from all 10 years was aggregated. This provided adequately large sample sizes to increase statistical power in order to make statistically valid inferences. Several other sources were consulted in order to compare NWT rates to national figures (Table 11). The Canadian Cancer Statistics Manual (2005 and 2012 editions) were used for cancer type-specific comparisons (e.g. colorectal, lung, breast, prostate, and oral cancers) while CANSIM tables from 2001 to 2007 were used for all other comparisons.

Data Sources Used for Analysis

Table 11

Data Source	Where Used
Canadian Cancer Registry - NWT extract	All cancer incidence calculations
NWT Vital Statistics	NWT mortality calculations, 2000-2009
Canadian Cancer Statistics Manual (2005 edition)	Canadian incidence for cancer type-specific (male oral cancer only)
Canadian Cancer Statistics Manual (2012 edition)	Canadian incidence for cancer type-specific (all others excluding male oral cancer)
CANSIM Table 103-0550	Canadian incidence by geographic jurisdiction comparisons
CANSIM Table 102-0563	Canadian mortality by geographic jurisdiction comparisons
CANSIM Table 103-0404	Referent incident rates for Canadian population
1991 Canadian Population	Reference population for all age-standardized rates

Analysis

Wherever possible, raw Canadian data were used as a comparator group. Due to suppressed cells in younger age groups for specific cancer types, these data could not be used for cancer type-specific analyses. Rather, the 2005 (mid-point year) age-standardized rates reported in the Canadian Cancer Statistics 2012 publication[70] were used as the comparator. The extremes in the range of values from the 2001-2010 interval was used as a proxy for the confidence interval since none were provided.

The methodology described in Finlayson et al.[71] was utilized to calculate direct age-standardized rates with confidence intervals. Canadian data were extracted from CANSIM tables 103-0550 and 102-0563 for comparisons between geographic locations and ethnicity. In order to limit the number of cells with zero values, both NWT and Canadian data sets were age-standardized using nine age groups. Standard errors were calculated on the Canadian data, as were standardized incidence rate ratios using the Poisson distribution, based on methods described by the International Agency for Research on Cancer.[72]

Ethnicity was determined from Territorial Health Card registration, which is self-reported when applying for health cards or by parents when registering births.

Limitations

Due to the small NWT population size, comparisons against other populations are challenging. Small numbers reduced statistical power to detect significant differences. In particular, high year-to-year variability creates unstable rates and wide confidence intervals. To mitigate this instability, 10 years of NWT data were combined. However, aggregating NWT data over several years produces another challenge, that of having to compare to a single year of Canadian data. Wherever possible, the analysis used raw Canadian data (from CANSIM tables) then age-standardized and combined years in a similar manner. This was not always possible, as in the case of the cancer-type specific analysis for lung, colorectal, breast, prostate and oral cancers.

After aggregating 10 years of NWT data, analyses were conducted on cancer types with 25 or more reported cases. As a result, comparisons between NWT and Canadian cancer rates were limited to the four most frequent types of cancer: colorectal, lung, breast and prostate. Age-standardizing rates where many of the nine age strata have values of zero can cause an underestimation in the true variance.[73] To eliminate the risk of falsely suggesting a significant difference when, in fact, there truly is no statistically significant difference, the analyses were limited to cancers with more than 25 reports.

Annex 2: Incidence Rate Tables

Age-Standardized Incidence Rates and Upper/Lower Confidence Intervals of the Top 5 Cancer Types by Sex

Rate Table 1

	Male		Female	
	Rate	95% CI	Rate	95% CI
Colorectal	82.2	(65.4, 99.0)	80.0	(62.8, 97.3)
Prostate	92.6	(74.9, 110.3)	N/A	-
Breast	N/A	-	106.6	(89.2, 124.1)
Lung	60.8	(45.7, 75.9)	61.1	(45.3, 76.9)
Oral*	20.7	(13.1, 28.2)	*	-

Age-Standardized Incidence Rates and Upper/Lower Confidence Intervals of Cancer Types by Ethnicity

Rate Table 2

	Overall		Colorectal		Lung		Breast		Prostate	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Dene	422.1	(363.1, 481.1)	123.8	(100.4, 147.2)	67.2	(49.7, 84.8)	50.0	(35.9, 64.0)	65.7	(40.9, 90.5)
Métis	330.4	(208.2, 452.7)	*	-	*	-	*	-	*	-
Inuit	385.4	(271.0, 499.8)	*	-	*	-	*	-	*	-
Non-Aboriginal	363.5	(306.2, 420.7)	63.4	(45.3, 81.4)	57.2	(38.8, 75.5)	53.2	(39.4, 67.0)	137.3	(99.3, 175.2)

Age-Standardized Incidence Rates and Upper/Lower Confidence Intervals of All Cancer Types by Community Type

Rate Table 3

	Male		Female	
	Rate	95% CI	Rate	95% CI
NWT	412.9	(374.7, 451.1)	385.4	(349.6, 421.2)
Yellowknife	408.4	(330.8, 486.1)	330.8	(271.8, 389.8)
Regional Centres	435.5	(362.4, 508.7)	426.0	(353.7, 498.4)
Small Communities	392.9	(336.0, 449.7)	390.8	(332.3, 449.3)

* Too few cases to produce age standardized rates

Age-Standardized Mortality Rates and Upper/Lower Confidence Intervals for the Top 5 Cancer Types by Sex

Rate Table 4

	Male		Female	
	Rate	95% CI	Rate	95% CI
Overall	225.7	(194.1, 257.3)	192.9	(164.7, 221.1)
Breast	*	-	24.1	(14.9, 33.3)
Colorectal	47.2	(32.5, 61.9)	30.8	(19.2, 42.4)
Lung	60.0	(43.8, 76.3)	53.9	(38.7, 69.0)
Prostate	27.9	(16.0, 39.8)	*	-

Age-Standardized Mortality Rates and Upper/Lower Confidence Intervals of Cancer Types by Ethnicity

Rate Table 5

	Overall		Colorectal		Lung	
	Rate	95% CI	Rate	95% CI	Rate	95% CI
Dene	238.1	(204.2, 271.9)	45.2	(30.3, 60.1)	64.9	(47.1, 82.8)
Métis	200.7	(129.3, 272.1)	*	-	*	-
Inuit	255.4	(186.5, 324.2)	*	-	*	-
Non-Aboriginal	160.8	(130.0, 191.6)	26.5	(14.0, 38.9)	44.0	(27.7, 60.4)

Age-Standardized Mortality Rates and Upper/Lower Confidence Intervals of All Cancer Types by Community Type

Rate Table 6

	Male		Female	
	Rate	95% CI	Rate	95% CI
NWT	218.7	(188.2, 249.2)	186.7	(159.2, 214.1)
Yellowknife	210.0	(144.8, 275.3)	205.7	(149.6, 261.9)
Regional Centres	232.8	(174.6, 291.0)	166.3	(116.9, 215.6)
Small Communities	216.5	(171.8, 261.3)	197.4	(154.2, 240.6)

* Too few cases to produce age standardized rates

If you would like this information in another official language, call us.

English

Si vous voulez ces informations en français, contactez-nous.

French

Kīspin ki nitawihtīn ē nīhīyawihk ōma ācimōwin, tipwāsinān.

Cree

TŁĮCHǪ YATI K'ĘĘ. DI WEGODI NEWǪ DÈ, GOTS'O GONEDE.

Tłı̨chǫ

ʔERIHTŁ'ÍS DËNE SÚŁINÉ YATI T'A HUTS'ELKËR
XA BEYÁYATI THEʔĄ ʔAT'E, NUWE TS'ËN YÓŁTI.

Chipewyan

EDI GONDI DEHGÁH GOT'ĮE ZHATĮE K'ĘĘ EDATŁ'ÉH
ENAHDDHĘ NIDE NAXETS'Ę EDAHŁÍ

South Slavey

K'ÁHSHÓ GOT'ĮNE XƏDǾ K'É HEDERI
ʔEDĮHTL'É YERINIWĘ NÍDÉ DÚLE.

North Slavey

Jii gwandak izhii ginjìk vat'atr'ijąhch'uu zhit
yinohthan jì', diits'àt ginohkhìi.

Gwich'in

UVANITTUAQ ILITCHURISUKUPKU INUVIALUKTUN, QUQUAQLUTA.

Inuvialuktun

ᑕᕆᐊᒃ ᑎᑎᖅᑲᐃᑦ ᐱᓕᒪᔪᐱᑦ ᐃᓄᖅᑎᑐᓪᓗᒍᓐᓃᖅ,
ᐅᓪᓗᑎᓐᓄᑦ ᐅᖅᑲᓕᕐᓇᖅᑐᑎᑦ

Inuktitut

Hapkua titiqqat pijumagupkit Inuinnaqtun, uvaptinnut hivajarlutit.

Inuinnaqtun

1-867-920-3367